
John S. Worley
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ATLANTIC COAST
SHIPBUILDERS
ASSOCIATION
COST ACCOUNTING IN
SHIPBUILDING
Report of the Committee on
Uniform Methods of Cost Accounting

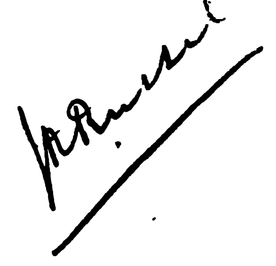




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ATLANTIC COAST
SHIPBUILDERS'
ASSOCIATION



COST ACCOUNTING IN SHIPBUILDING

Report of the Committee on
Uniform Methods of Cost Accounting

Adopted June 4, 1919

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Transport.

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FOREWORD

The Atlantic Coast Shipbuilders' Association submits to its members the following report of its Committee on Uniform Methods of Cost Accounting. The shipyards, which have been long established, have of course methods of cost accounting that are the result of many years of experience. These shipyards, however, have cooperated in the work of the committee, and, it is believed, will find the report a means of improving their methods.

Those shipyards organized during the war emergency, which lack the experience necessary to establish proper methods of cost accounting, should find the report of real constructive value.

The shipbuilding industry is under great obligation to the Committee of the Association for the work it has performed, and particularly to Chairman H. Birchard Taylor, Vice-President of William Cramp & Sons Ship & Engine Building Company, who has given much time to the work of the Committee, with the only object in view of being helpful to the shipbuilding industry.

The Association has now taken another important step by appointing a committee to assist in applying the methods set forth in the report and to act in an advisory capacity in dealing with cost accounting questions that may arise in the individual yards.

HENRY C. HUNTER,
Secretary.

Report of Committee on Uniform Methods of Cost Accounting

ATLANTIC COAST SHIPBUILDERS' ASSOCIATION

LETTER OF TRANSMITTAL

In undertaking the work of examining the prevailing methods of cost accounting in the shipyards, and preparing recommendations for the purpose of securing uniform and improved methods, the committee has been assisted by J. L. Jacobs & Co., Industrial Engineers and Cost Accountants, of Chicago. Mr. Jacobs and his assistants have made a careful examination of existing methods and have visited about twenty-five shipyards on the Atlantic Coast and Great Lakes for this purpose.

From an analysis of existing methods in the shipyards and the consideration of cost accounting methods in other industries, they have prepared for the committee a comprehensive plan of cost accounting and cost finding which covers the major principles and elements of methods which are capable of adoption by the shipyards. The principles and methods thus developed have been given careful consideration by the committee and have been revised in accordance with the views of the members.

A number of the larger shipyards have reported that about 90 per cent of the plan outlined is in agreement with the methods which they now use. It has been endeavored to make the methods as flexible as possible so

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rious yards to secure uniformity of practice in regard to such questions as terms of payment, liabilities, and numerous other factors.

The committee realizes that uniform methods of cost accounting cannot be adopted without subjecting each yard to some inconvenience, but it is hoped that the advantages to all which would result from the adoption of the standard methods would very much more than offset the inconvenience in making the change. We trust that each yard will co-operate unselfishly in carrying out this work.

Respectfully submitted,

COMMITTEE ON UNIFORM METHODS OF COST ACCOUNTING.

H. Birchard Taylor, *Chairman*,
Wm. Cramp & Sons S. & E. Building Co.

A. A. Cannon,
Downey Shipbuilding Corp.

Creighton Churchill,
Emergency Fleet Corp.

E. Eckardt,
Chester Shipbuilding Co.

W. L. Lewis,
Bethlehem Shipbuilding Corp.

Frank McLaughlin,
Mobile Shipbuilding Co.

W. Richmond Smith,
Emergency Fleet Corp.

Dwight True,
Great Lakes Engineering Works.

J. T. Wickersham,
New York Shipbuilding Corp.

June 4, 1919.

UNITED STATES SHIPPING BOARD

EMERGENCY FLEET CORPORATION

140 North Broad Street, Philadelphia, Pa.

June 5, 1919.

Mr. H. B. Taylor, Chairman,
Committee on Uniform Methods of Cost Accounting,
Atlantic Coast Shipbuilders' Association.

Dear Sir:

Representing the Emergency Fleet Corporation of the United States Shipping Board upon your committee, we desire to express our general approval of the recommendations contained in your report to the Association. If adopted these recommendations will, in our opinion, provide a sound basis for the creation of an adequate and effective uniform system of cost accounting which can be worked out in detail in such a manner that it may be installed in any shipyard without extensive changes in existing methods.

We desire to point out, however, that, while your committee has been able to secure agreement upon a satisfactory work program, there still remains to be worked out forms and procedure and all the detailed machinery of operation before any uniform cost accounting system is created which can be installed in the shipyards.

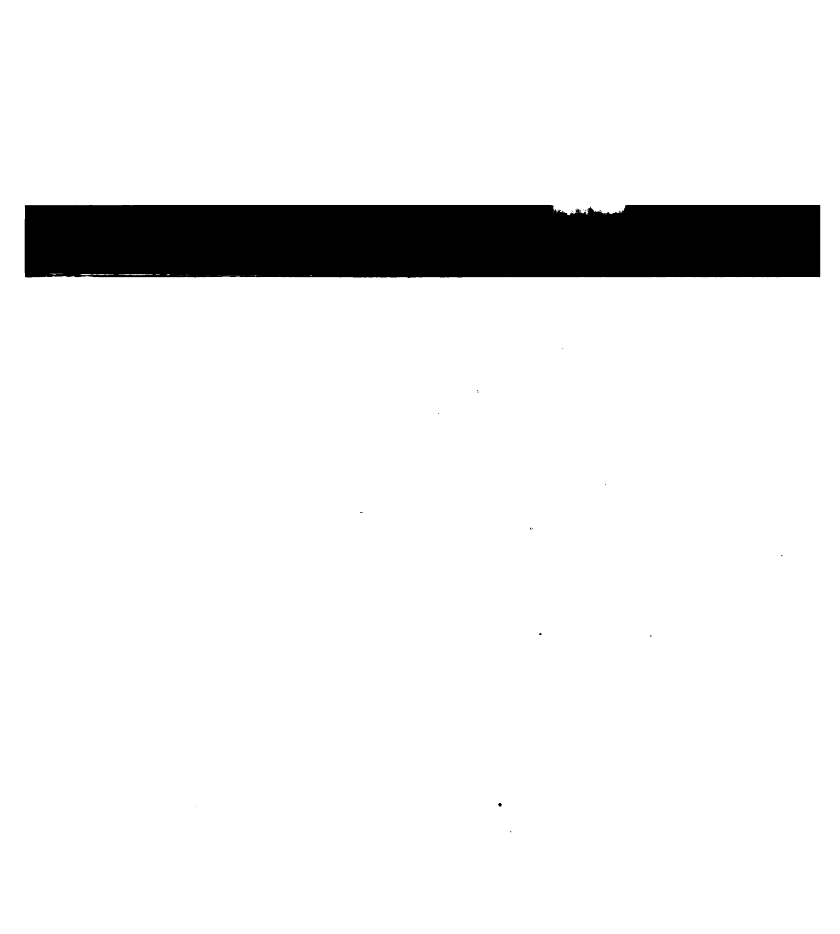
Your committee has recommended that supervision of this second, and most important, step in the program of providing a uniform cost accounting system for Atlantic Coast shipyards be entrusted to a new committee to be appointed by the Association.

We desire to emphasize in the strongest possible manner the vital importance of the recommendation contained in your report that this new committee be composed of men representative in every way of the shipbuilding industry upon the Atlantic Coast, and that the committee be given adequate powers to act, with the complete cooperation of every member of the Association.

Very truly yours,

CREIGHTON CHURCHILL,
W. RICHMOND SMITH,
Members of Committee for Emergency Fleet Corporation.

Approved:
W. B. HOLTON, JR.,
Acting Vice-President.



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Report and Recommendations

ON

Uniform Methods of Cost Accounting

IN

Shipbuilding

ADOPTED JUNE 4, 1919

ATLANTIC COAST SHIPBUILDERS' ASSOCIATION

COMMITTEE ON UNIFORM METHODS OF COST ACCOUNTING

H. BIRCHARD TAYLOR, *Chairman*,
Wm. Cramp & Sons S. & E. Building Company

A. A. CANNON,
Downey Shipbuilding Corporation

CREIGHTON CHURCHILL,
Emergency Fleet Corporation

E. ECKARDT,
Chester Shipbuilding Company

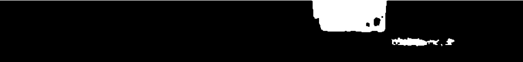
W. L. LEWIS
Bethlehem Shipbuilding Corporation

FRANK McLAUGHLIN,
Mobile Shipbuilding Company

W. RICHMOND SMITH
Emergency Fleet Corporation

DWIGHT TRUE
Great Lakes Engineering Works

J. T. WICKERSHAM
New York Shipbuilding Corporation



SECTION I

INTRODUCTION

Object and Scope of Plan

The object of this study has been to develop those basic principles and elements which make possible the establishment of uniform methods of cost accounting in shipbuilding. The plan recommended includes the important principles, definitions and elements of standardized cost methods which are applicable to any of the shipyards.

To establish uniformity in cost accounting, it is essential that definiteness and standard methods be first established in the controlling items and divisions. These are of particular importance from the point of view of executives, who will be enabled currently to visualize production and operating conditions and to compare costs with standards in their own shipyards as well as with other shipyards.

No attempt has been made to cover the numerous details and ramifications of accounting, timekeeping, storekeeping, forms, etc. Questions on such matters and details are either now covered or should be left to be developed in the individual shipyards. The important principles and elements for adequate cost-finding methods will serve as proper guides for the arrangement of the above and other necessary details.

Advantages of Uniformity in Cost-Keeping

In the preliminary statement on uniform cost methods for shipbuilders which was submitted on November 1, 1918, through the courtesy of the Emergency Fleet Corporation, there is included an outline of the needs and advantages of uniform cost methods in the shipbuilding industry. These benefits have been considered in the development of the principles and methods which are set up in this report.

Shipbuilders and business men in general fully recognize the value of accurate cost statistics as a means of establishing standards for estimating and for comparing operating efficiencies, and for providing proper bases of production costs and selling prices.

The need for and advantages of uniform cost methods in the shipbuilding industry are intensified when the varied activities and output of shipyards and the possibilities for incomplete figuring of costs and losses in production are considered.

While it is possible, it is not essential for purposes of comparison for the uniform cost methods to furnish scientifically accurate figures. The main object and the important advantage of the use of uniform methods is that all costs will be included and figured in the same way.

The primary advantages and reasons for the use of uniform cost-finding methods can be stated as follows:

1. Reliable guide and basis for estimating prospective business.
2. Complete costs of specific articles and indicator of profitable and unprofitable production and service activities.
3. Gauge of the value, efficiency and wastes of workers, machines, methods, operations and plants.
4. Uniform terminology enabling comparisons of progress and efficiency of production between units in shipyards and between groups of shipyards.
5. Supplementing of general accounts of shipyard with cost accounts and proving of accuracy of costs and adequacy of methods through general bookkeeping system.
6. Ease with which cost and progress figures may be arranged in a simple, tale-telling manner.
7. Control of operation and production standards through current periodic cost figures.
8. Visualization of business conditions by executives through logical arrangement of figures.
9. Insurance against unintelligent competition and unprofitable undertakings.
10. Current reports for comparing of major cost items with standards, which are predetermined, and measuring and increasing operating efficiency.
11. Coöperation and friendly competition resulting from cost comparisons.

Accounting Methods at Present in Use

As a result of the examination of prevailing practices and methods in about twenty-five shipbuilding companies (representing over sixty shipyards) variations in the development of cost accounting, in the treatment and figuring of costs and in the coördination of general accounts with operating cost records have brought out pointedly the need of definite action on the adoption of standard principles and uniform cost accounting methods.

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a) Accuracy.

Relationship of Cost Accounting and Financial Accounting

The fundamental purpose of a cost accounting system is to furnish executives current production and operating statistics so unified and arranged that every fact it presents is related to a common whole. Comparisons of costs of material, labor and expense charges with standards serve as a basis of forming intelligent manufacturing and selling policies as well as control over internal operating conditions and practices. Thus cost accounting deals with the internal operating conditions and presents current and comparative pictures of progress and manufacturing efficiencies, while general accounting has to do largely with the external affairs of management, furnishing complete accounts of expenditures and receipts of the business over given periods.

It is plain that an analysis of expenditures will not give costs, because such analysis will contain items of expenditure which may not as yet have entered into the cost of a production unit and may not contain items which have entered into the cost but have not yet been paid for. Through the coördination of the general accounting and cost accounting records, there is obtained an absolute check on the accounting work, as well as a current control over the various operations and activities of the organization.

Accounting and cost accounting are complements in the operation of any industry. The whole chain of information included in cost statistics must be tied in with the general accounting system so that there will be a control in the general books of all items occurring in the cost records. The monthly balance sheet of each ship-

yard should furnish to the management not only a summary of financial conditions but should be so tied in with current operations as will give complete inventories of production.

It should be thoroughly understood that in securing current costs and comparisons of production and operating efficiency it will not be necessary to disturb the general accounting system to any great extent. In those shipyards where items of expenditures are already being classified in detail, any uniform cost reports would be obtained through the re-grouping of certain of those figures to furnish necessary cost figures for purposes of operating control and to serve as a basis for the formation of intelligent production and selling policies.

These advantages to individual shipbuilders and to the industry as a whole will be obtained through adoption of the standardized principles and the use of the uniform methods which are here recommended. It is clear, however, that any plan or methods which are adopted will prove of greatest value only when back of the plan there is complete understanding, persistence and enthusiasm in the entire organization, and particularly in the cost organization. The cost organization should not only be concerned in the collection and arranging of figures with thoroughness and accuracy, but should be in the position of developing standards and setting up "high spot" cost statistics which will regularly and promptly be served to the executives as clear pictures of operation costs and production results. Under such conditions cost methods assume real importance and become a profitable investment.

SECTION II

BASIC DIVISIONS OF SHIPYARD ACTIVITIES

Major Considerations in Classifications

Examinations of the shipyard organizations, of the physical plants, and of the activities in the shipyards, bring out clearly the diversity and number of classes of activities and product units. At one extreme, there are the shipyards which manufacture and fabricate their own hull steel and engines complete from basic raw materials and also manufacture much of the ship outfit. At the other extreme, there are those shipyards which purchase complete engines, machinery, etc., as well as fabricated steel for hull and buy much of the ship's outfit. Between these two extremes are numerous variations and modifications.

Any standardized methods of determining costs in shipbuilding which do not recognize the basic divisions and major differences in activities and products must of necessity be incomplete or superficial. The basic lines of distinction or classification must be so fundamental that they will be adaptable to the variations in activities and products which exist in any shipyard.

Cost methods consist essentially of the collection and arranging and applying material, labor and expense charges to job accounts, orders or contracts in a way as will furnish adequate costs and continuous control of production and operating efficiency. The first thing, therefore, in the development of standardized cost meth-

ods is to define the plant activities and product units and departments through which it is desired to collect charges, so that such charges will at all times be confined to the same items and that there will be no confusion in the distribution and arrangement of the charges.

Classifications of the major activities, product units and departmental divisions in the shipyards for the purpose of uniformity in ascertaining and applying costs have been drawn up in such a way as to be applicable to all shipyards. Any individual plant can use those items which are applicable and omit those items which are not applicable. Also, each yard can, where desired, develop any detail subdivisions under each of the main items without in any way affecting the general classifications or the purpose of the standardized plan of cost accounting.

Classification of Shipyard Work

The main divisions of shipyard work are indicated under the series of shipyard production orders, the purpose, use and basis of classification of which are described under Section VIII: "Production Orders—Classification and Methods."

The main shipyard activities are classified under the following general series:

1. Construction Orders—Ships.
2. Construction Orders—Ship Product Stock.
3. Construction Orders—Special Contracts.
4. Auxiliary and Stock Manufacture Orders.
5. Defective Work Orders.
6. Vessel Repair Orders.

7. Construction and Betterment Orders—Plant and Equipment.
8. Repairs and Maintenance Orders — Plant and Equipment.
9. Miscellaneous Orders (work for others).

A plan of furnishing production or job orders authorizing and indicating the work which is to be done and having such orders issued to the operating departments in advance of actual beginning of work is essential where adequate and current costs are to be obtained.

The issue of a production or job order is the authority to proceed on work whether the work consists of manufacture of a completed product or parts, special repair work or stock manufacture. Each order authorizing work to proceed is given a production order number by which the job or contract is thereafter known and distinguished from all the other orders.

Through this means, the application and control of all elements of cost is facilitated and it becomes possible to trace any job account or order through the different stages of production.

Shipyard Product Unit Classification

Analysis of the organization and functions in shipyards which was made for the purpose of determining the basic divisions in shipyard work has led to the definite conclusion that the basis should not be location, i.e., a classification as between work in the shop or work in the field (yard). It is also clear that, for purposes of uniformity in methods and comparative cost figures as between shipyards, the basis of the shipyard product divisions should be more elemental than the ship parts

basis, i.e., distinction between the hull, machinery and outfit.

The division, which will permit of proper standardized methods in cost-finding and which is practical of application in shipbuilding, is based on the functional division of shipyard work into two primary classes into which shipyard activities group themselves, namely:

1. Manufacture of Ship Parts.
2. Ship Construction and Machinery and Outfit Installation.

Manufacture of Ship Parts

Manufacture of ship parts as used in the classification includes all work and operations involved in fabrication or machining, or other work to put raw materials or component parts into a state where such parts are ready for assembling and ship construction. This division also includes all work and operations involved in the manufacture of raw materials (except work in stock manufacture) or such component parts which become a part of engines, machinery, piping and ship outfit and other ship parts, where they are ready for installation into the vessel.

Ship construction and machinery and outfit installation, as used in this classification, includes all work and operations involved in assembling and erection of steel hull, all steel work on hull, all woodwork and the installation of engines, machinery and fittings, outfit and finishing and the work in the delivery of the vessel to the owner.

Steel Ship Product Units

The primary functions (1) Manufacture of Ship Parts, and (2) Ship Construction and Machinery and Outfit Installation, naturally divide themselves into subdivisions based upon divisions of hull and the parts or groups of engines, machinery, outfits, etc. Each subdivision or group in turn consists of a number of similar units of specific parts which when assembled with other units make up the group.

The main subdivisions of each of the primary functions are as follows:

1. Structural Hull.
2. Machinery.
3. Hull Finishing and Outfit.

The discussion of the uses and divisions of these sections and subdivisions, as well as the code designations used, is included under Section IX: "Ship Product Units —Classification and Methods."

The product units constitute the job accounts to which all direct charges of labor and material and the distribution of expense should be made. These job accounts or product units will thus be the basis of the outlines for cost summaries and cost estimates as well as for the payment for work completed.

Direct General Charges—Ship Production

In addition to these main subdivisions, there is included under the main division of ship construction and machinery and outfit installation the group of accounts which cover the direct charges, which are of a general character.

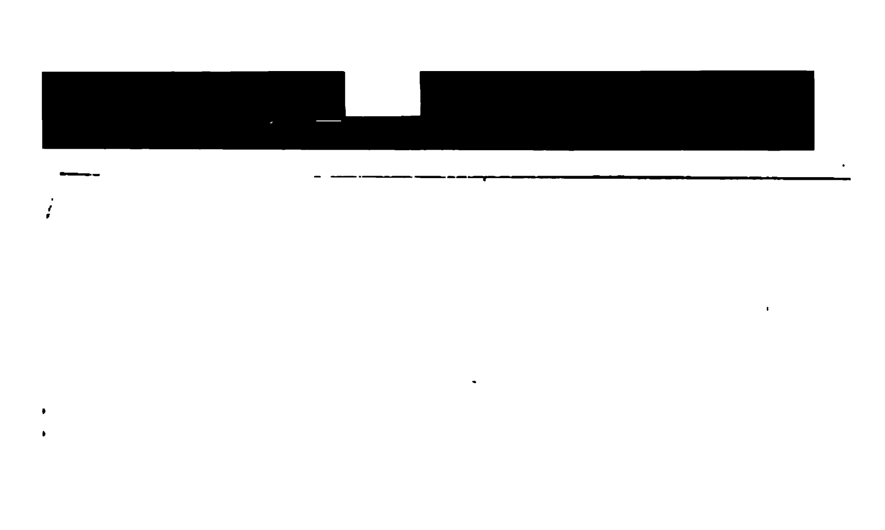
Such expenses as insurance and classification fees; cost of staging, shoring and fairing; testing and inspection; launching and entertaining; trials and delivery, etc., as are incurred on any job or ship contract, should be applied directly to the job account or contract. The details of such direct general charges are included under Section IX: "Ship Product Units—Classification and Methods."

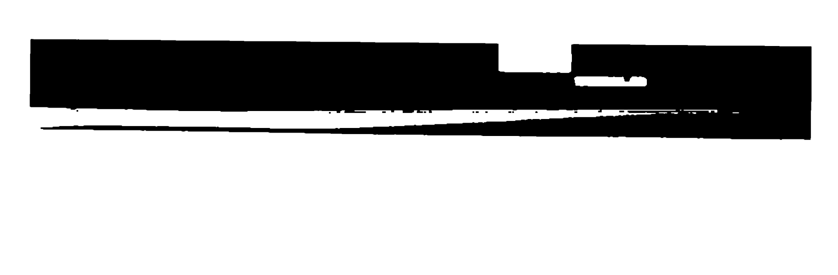
Where it is desired to find cost on the individual parts, the classification can be extended in accordance with the code symbol plan indicated under the section above referred to. An alphabetical list of all these parts should be prepared showing the proper classification of the structural units which fall under the main headings, where subsidiary divisions will be used to keep detail costs.

Departmental Classification

For purposes of proper gathering and distribution of expense or overhead charges and for closer control of the elements of costs and of production, all costs should, in so far as it is possible, be gathered and applied to job accounts or product units by departments. Careful distribution of expense and proving of costs through the departments furnish more accurate cost charges and serve as valuable means for operation and efficiency control.

The classification of departments which is included under Section X, "Shipworks Departments—Classification and Methods," shows the typical departmental divisions which are found in a shipbuilding organization. The main divisions set out therein are as follows:







1. **Productive Departments.**
2. **General Works Departments.**
3. **General Works Distributive Departments.**
4. **Auxiliary and Stock Manufacturing Departments.**
5. **General Administrative Departments.**

SECTION III

PRINCIPLES AND GENERAL DEFINITIONS—ELEMENTS OF COST

The acceptance of certain basic principles and definitions of costs is the first step for uniformity in cost accounting methods. The principles and definitions of general methods which follow control the entire plan for uniform cost methods in the shipbuilding industry.

The adoption of these by shipbuilders will go a long way toward eliminating the large number of divergent practices, and will do more than anything else toward the establishment of uniform and positive methods in cost-finding.

Elements of Cost

The elements of cost entering into the production of any article or product are made up of three primary divisions, viz.: "Material," "Labor" and "Expense."

Elements of operation of any organization always reduce themselves to the above primes, and they are therefore identical in cost accounting for all shipyards. Every item of output, whether it be a part or a completed machine or a structural unit of a ship or the complete ship, will contain the elements of direct labor, direct material and expense.

These elemental costs divide themselves into two distinct groups, viz.: "Direct Cost Charges" and "Indirect Cost Charges."

Direct Cost Charges

Direct cost charges consist of those cost elements which can be applied directly against a job account or order on which work is done. Such direct charges include the charges for the cost of direct labor, direct material and certain items of direct expense, which, because of their nature, can be charged directly to the job account or order.

The principles and specific definitions for direct labor charges are included under Sections IV and V, which are the sections treating on principles and definitions of material and labor.

Indirect Cost Charges

Indirect cost charges consist of those cost elements which cannot be applied directly to a job account or order and are included under the element of "expense."

The principles and specific definitions for "expense" (often referred to as "overhead," "burden" or "indirect charges," etc.) are included under Section VI, "Expense."

Direct Labor Costs

Direct labor costs consist of wages paid to productive or direct labor which can be charged directly to job accounts or orders, and also include allowances for overtime and premiums paid to direct labor as production bonuses.

Direct Material Costs

Direct material costs consist of the costs of all articles, substances, parts and equipment which enter into and become part of the product and which can be charged directly to some definite job account or order.

Expenses

Expenses consist of all incidental expenses for indirect labor, indirect material, supplies and other items of expense, including such items as supervision; such operating charges as repairs, supplies, motive power, lighting and heating; and the fixed charges, such as rent or floor space, interest paid or accrued, taxes (exclusive of income and excess profits taxes), insurance and depreciation.

General Definition of Total Production Costs

The term "total production costs" as used in the plan for uniform cost accounting methods is defined to include:

(a) The cost of all direct material definitely ascertainable as entering into and forming a part of the product.

(b) The cost of all direct labor definitely ascertainable as used in the production of the product.

(c) The pro rata shares of productive departmental, distributive, general works and general administrative expenses.

SECTION IV

PRINCIPLES AND SPECIFIC DEFINITIONS—MATERIALS

Materials and Supplies

The materials and supplies classification and methods shown in Section XI will furnish the basis for control of purchasing, receiving, storing, issuing, pricing, assembling of material costs and inventory.

As the direct material is handled through the various processes of manufacture in the different production departments, it is essential for proper checking and cost-finding to have adequate control through a centralized stores control system.

Stores Control

Requirements for the purchase of materials should originate in the engineering or production department, where the bills of materials are prepared. Purchases should be made through the purchasing department in connection with stores requirements. Copies of purchase orders should be sent to the stores department so that receipt of materials can be checked with purchase requirements, and no stores should be issued from stock except upon written requisition.

Material before being used in production should either be held in a stores department and charged out to active production or requisition, or, in the case of large items

being held for particular product units, they should be held in special stores accounts until charged out to work in process.

To obtain control of stores and material, the purchasing department should set a price on the cost of the material at the time of the issue of the order, and such prices should be used in the billing out of the material from stores, except in those cases where actual invoice prices are available at the time of issue of material, in which cases the latter prices should be used.

Direct Material

Direct material consists of all articles, substances, parts and equipment which enter into and become part of another product, the costs of which can be charged directly to some definite job account or product unit.

Contract Materials

A clear distinction should be made between the direct material in connection with cost charges to job accounts or product units and the so-called direct materials or "contract materials" purchased for a specific job or order. It is recommended that in such cases where materials or articles are purchased for any specific contract, job or order that those materials be referred to as "contract materials" instead of being referred to as "direct materials."

Indirect Materials and Supplies

Indirect material and supplies consist of such materials and supplies which, while used in the processes of manu-

facture, either do not enter directly into the product or else enter it in such a way as not to be chargeable conveniently to any particular job account or product unit.

Supplies as defined in "Classification of Materials and Supplies" are used by practically every department of a plant, and the cost of such supplies should, in so far as it is possible, be charged to such departments as expense.

In such cases, where it is not feasible to charge the cost of materials directly to a job account or product unit, the cost will be treated as indirect material, and the expense will be applied to the specific departments which have the use of such materials.

Pricing of Materials and Supplies

In charging the cost of materials or supplies against job accounts or product units or against any specific department, the price set out by the purchasing department of the cost of materials should be used in billing out the materials from stores and adjustment made periodically with the net price of such material. The net price will be obtained after adding to the invoice cost any direct charges, such as express, freight, drayage, etc.

When material is bought at different times, and at various prices, and it is not practicable to use a definite purchase figure, an average price should be computed for material put into process. This method of arriving at what might be termed a "base price" should apply particularly to general stores items and certain specific items of material.

On bar steel, receipts and disbursements should be added monthly both as to weight and cost. By subtracting the disbursements from the receipts and the total on hand at the beginning of the period, the remaining weight should be divided into the difference in cost to determine the base price for the following month's charges.

In those cases where it is practical to keep lumber according to lots purchased, requisitions for lumber should be charged at the actual lot cost. This method should be used in all cases where prices fluctuate widely.

On all materials and items manufactured in the shipyard, such as products from the foundry, paint manufacture department, etc., the price charged should be that of the actual total cost of manufacture. As these products go into stock they will be issued at base prices, as suggested above.

In the case of fuel, a record should be kept of each kind of fuel and a base price determined for purposes of charges to expense in the different operating departments.

Tools

For purposes of cost charges, tools, etc., should be divided into two main divisions, viz., asset tools and small perishable tools.

The cost of all asset tools (other than special tools which are purchased and used on special work, for which charge will be made directly against the job account or

product unit), should be included as an asset, subject to depreciation charges.

The cost of all small perishable tools should be included as part of expense and should be charged to the specific departments in which they are used. In those cases where special small perishable tools are purchased or used on special work, charges for same should be made directly against the job account or product unit.

As a guide for distinguishing asset and small perishable tools, there is reproduced in Appendix "C" a classification of tools which was compiled by leading tool manufacturers of the country as a result of conferences held for the purpose of determining from the name and nature of the tools whether or not such tools should be classed as asset or perishable articles.

Scrap Material

Where scrap material is used or sold, the income derived from the sale or value of such scrap should, wherever it is practical, be credited to the job account or product unit from which the scrap was obtained.

In those shipyards where the scrap material is used for the manufacture of other articles or products, it will become a direct material charge, to be applied to the particular products manufactured from scrap.

Packing Supplies and Salvage

The cost of packing supplies, such as containers, etc., should be charged as part of general works expense, which expense accounts should receive credit for any salvage.

Handling and Storing Material

The cost of handling and storing materials and supplies should be charged as part of general works expense. While in some cases it may be desirable to add such costs to the invoice cost of materials and supplies, it is suggested that for the purposes of simplicity and uniformity the method above recommended should be used.

SECTION V

PRINCIPLES AND SPECIFIC DEFINITIONS—LABOR

Labor Cost Charges

The second element of cost is "labor," and this element, as in the case of material, is divided into two classes, namely:

(a) Direct or productive labor.
(b) Indirect labor.

The definitions of direct labor and indirect labor as applied to costs follow.

Direct Labor Charges

Direct labor charges should include wages paid to labor which can be charged directly to job accounts or product units, and should also include allowances for overtime and premiums paid as production bonuses. The wages and premiums of Quartermen and Leadingmen should be charged directly to the job accounts or product units with the other charges for direct labor. This practice is based on the fact that these employes are working foremen and the labor cost is made a direct charge in order to observe the general principle of charging as much labor as consistent direct instead of indirect.

Direct Labor Hours

Direct labor hours include the number of productive hours of direct labor employed on and whose wages can be charged directly to job accounts or product units.

In the case of piece workers, the hours of work should be kept in addition to wages earned.

Indirect Labor Charges

Indirect labor charges should include the salaries and wages of supervising and administrative employes, where the costs cannot be charged directly to job accounts or product units and which are included under the element of "expense."

There is a divergence in practice in different shipyards in the treatment of wages of foremen and similar supervising labor. In some instances charges are made directly to job accounts or product units, while in others such supervisory labor costs are included as part of productive departmental expense.

For purposes of good practice and uniformity in cost accounting, all wages of foremen and other supervising labor (except Quartermen and Leadingmen as indicated above) should be treated as a part of productive departmental expense.

Labor Classifications

The classifications of positions and occupations and of major labor operations for use in payroll preparation and distribution and control of labor costs, are set up under Section 12—"Labor Classifications and Methods."

Salaries of Executives

Salaries paid to executives for services rendered in connection with the general administrative and financial affairs of a shipbuilding company should be treated as charges against production costs.

In those cases where executives divide their time between general administrative duties and work in connection with obtaining contracts or sales, the pro rata share of such salaries should be charged to sales expense and the remainder should be charged as part of general administrative expense.

Time-Keeping

For adequate and accurate labor cost charges, it is essential that proper time-keeping methods be established in order:

(1) To make sure that the time and labor operations reported are complete and accurately given.

(2) To make sure that the total labor distributed to costs will check with the total payroll.

(3) To collect and analyze the time of each worker according to major labor operations.

Cost Periods

The practice with reference to the periods for closing of cost accounts and general accounting records varies in different shipyards; some of the yards closing their books at the end of the calendar month, other yards every four or five weeks, others every thirty days, etc.

The splitting up of payrolls for the odd days and distribution of costs in preparing cost statistics involves considerable time and work and does not give entirely accurate or uniform cost reports.

For purposes of simplicity and uniformity, the periods for closing cost accounts and comparing cost summaries should consist of four or five weekly payroll periods, the number of weeks in any period depending on the nearness of the last day of the weekly payroll period to the end of the calendar month.

SECTION VI

PRINCIPLES AND SPECIFIC DEFINITIONS—EXPENSE

Expense

The element of expense includes all expenses for indirect labor, indirect material and other items of expense, including such items as departmental supervision, such operating charges as repairs and renewals, supplies, motive power, light and heat, and the fixed charges, such as rent, interest paid or accrued, taxes, insurance and depreciation.

Expense Classification

A detailed list of the expense items and the distribution of such expense accounts under the main expense divisions are included under Section XIII, "Expense—Classification and Methods."

The main divisions of expense shown in the expense classification are as follows:

1. Productive Departmental Expense.
2. General Works Expense.
3. General Works Distributive Expense.
4. Auxiliary and Stock Manufacturing Expense.
5. General Administrative Expense.
6. Fixed Charges Expense.

Main Expense Definitions

The definitions of these main divisions as well as the principal expense accounts to which all charges are made for expenses which contribute to and are necessary in connection with production, but which cannot be applied

directly to job accounts or product units, are included under Section XIII, "Expense—Classification and Methods."

They are repeated here for reference purposes, as follows:

(1) *Productive Departmental Expense.*

Productive departmental expense includes the indirect charges of the respective productive departments. Distribution of productive departmental expense to job accounts, orders or articles is discussed under heading of "Distribution of Expense," which may be found elsewhere in this section.

(2) *General Works Expense.*

General works expense includes the indirect expenses chargeable to production cost which cannot be charged directly to some definite productive department and which cannot be applied to any of the other classes of expenses in the classifications which follow.

(3) *General Works Distributive Expense.*

General works distributive expense includes all expense directly or indirectly attributable to the operation of the general works distributive departments.

(4) *Auxiliary and Stock Manufacturing Expense.*

Auxiliary and stock manufacturing expense includes all expenses incurred in the operation of an auxiliary and stock manufacture department.

(5) *General Administrative Expense.*

General administrative expense includes all expense in connection with the conduct of the general administration or office activities of a shipbuilding company, other than those identified with a particular works.

(6) *Fixed Charge Expense.*

Fixed charge expense includes all expense such as rent or floor space, taxes, interest paid or accrued on borrowed money, insurance and depreciation, all of which expenses are more or less fixed in character and which are incurred whether the plant is in operation or not.

Repairs, Renewals and Betterments

The cost of maintenance, including repairs and renewals, when such repairs to the plant, equipment or tools are of a minor character, should be considered and included as proper charges against production costs. Such charges should be applied directly to the specific department for which such repair and renewal work is done.

The costs of repairs or renewals which are more extensive and not regularly recurring in character and which may lengthen the life of the item, constitute proper charges against the reserve for depreciation. The charges for such repairs and renewals as well as replacements of worn-out equipment or machinery should be applied against depreciation reserve.

The costs of betterments which are extraordinary in character and which are in the nature of additions, making the property, equipment or machinery more useful or of greater capacity, are not proper charges against production costs, nor are they proper charges against depreciation reserve. Such betterments constitute additions to the capital investment and the costs should be added to the capital account.

Definition of Betterments

The following definition of betterments, as prescribed by the Interstate Commerce Commission for telephone companies (Uniform System—First Issue, Jan. 1, 1913, p. 32) is reproduced as a guide in determining the items which should be charged to capital accounts:

> "Betterments are mechanical changes in structure, facilities, or equipment which have as their primary aim and result the making of the properties affected more useful or of greater capacity than they were at the time of their installation or acquisition. The cost of such portion only of the changes incident to betterments as will, when added to the original cost of the property bettered, give the cost of replacement or reconstruction in present condition of the property as bettered should be charged to plant account. The remainder of the cost of the change should be classed as a repair and be charged to the appropriate operating expense accounts."

Express, Freight and Drayage (Inward)

Where it is feasible, the cost of incoming express, freight and drayage should be added to the invoice cost of material, so that the direct material charge when made to a specific job account will include the material cost, plus cost of express, freight and drayage. When such treatment is impracticable, the cost of such express, freight and drayage should be treated as an item of expense.

Spoiled or Defective Work

Spoiled or defective work should be included as part of production cost where the quantity and cost of same is not more than the average amount under normal con-

ditions, and where same was not within the control of the operating departments. Charges for such spoiled or defective work should be made in the same way as charges for other job accounts or product units. A separate schedule of all the important items of spoiled or defective work should be maintained; indicating the nature of the defect, where and how it occurred, together with the cost and salvage value.

Engineering and Drafting Expenses

The costs of engineering and drafting work should, wherever it is feasible, be charged direct to the job account. When such treatment is impracticable, such costs should be treated as part of expense.

Division of Administrative Expense

That part of general administrative expense which is incurred in the conduct of general administration or office activities of a shipbuilding company should be considered a proper charge against production costs. In those cases where there is a division between the general administrative work and work in connection with obtaining contracts and sales, a pro rata share should be charged to sales expense, and the remainder should be included as part of the general administrative expense.

Advertising

The costs for advertising in connection with the securing of employes, services, etc., should be considered as an item of production costs and should be charged to general works expense.

Advertising which has to do with securing new business should not be included in production costs, but should be treated as part of sales expense.

Sales Expenses

Sales expenses are not proper charges against production costs but are proper charges against profit and loss. Sales expenses include the costs incidental to the administration and operation of the selling department plus such shares of other general expense which must be added to take care of the sales activities.

Sales expense should be kept entirely separate from production costs, which latter costs represent the figures which are desired by the executives for operating control and by the shipbuilding groups in making comparisons of production and costs.

Distribution of Fixed Charges

The fixed charges indicated below will be distributed separately period by period to the various departments according to the value and nature of fixed assets or service obtained. The total of these accounts chargeable against a definite department for a period constitutes the fixed charges for that department.

It is suggested that reserve accounts be set up for each fixed charge to which should be credited each period the amounts which are charged to production costs. The basis of the amounts which should be credited to the reserve accounts and the charges to production costs are set out under the respective headings of fixed charges.

Rent or Floor Space

Rent or floor space costs, where such are paid for use of property in connection with production, should be applied to the respective departments using such space. The total of such charges should be pro rated period by period to the departments according to the floor space occupied.

The scale of floor space rates, which should be prepared in advance, should have a relation to the desirability of the space.

Discounts

Discounts form a part of capital expense or capital income and should be considered in the profit and loss account.

Interest

The method of treating interest in cost finding is one that has been discussed perhaps to greater extent than any other expense distribution matter. There is no intention of discussing the different opinions on this question in this report.

Where the output of any works consists of a number of products of differing types and character, the manufacture and assembling of which require different classes of plant, machinery and equipment, each involving large expenditures, the interest on the cost of such machinery and equipment should be included in production costs. Through this means it will be possible to obtain the actual cost of different products and proper distribution of charges against the job accounts or orders.

Because of the number of activities and great variations in the types and costs of plant, machinery and equipment required, consideration might be given in costs to the amount of capital invested. The basis of the interest charge on fixed assets would be the net value of the plant assets, i.e., the cost of plant, machinery and equipment less the amounts written off for amortization and depreciation. A normal fixed rate of interest would be used in calculating the interest charge, and this charge would be apportioned to the various departments based upon the net value of the fixed assets.

It is the opinion of the Committee on Uniform Methods of Cost Accounting that, for the present, only interest paid or accrued on borrowed money (bonds, mortgages and notes) should be considered as a charge to production costs.

Insurance

Insurance, including fire, burglary, fidelity and employers' liability insurance, should be included as part of production costs, and such expense should be distributed to the departments on the basis of value of plant equipment or material, or in the case of employers' liability insurance should be distributed according to the average amount of salaries and wages chargeable to each department.

Taxes

Taxes, including general property taxes, municipal and state taxes, should be treated as part of production costs. All income taxes, excess profit taxes and capital

stock taxes are not proper charges against production costs and should be included in profit and loss.

Taxes on property, machinery and equipment will be distributed according to the value of such property, machinery and equipment in each department.

Taxes on express, freight and drayage should, wherever it is practicable, be charged directly to the cost of material or supplies. When such treatment is impracticable, it should be treated as part of the general works expense.

Depreciation

The question of standardizing the rates of depreciation and the methods of applying depreciation in the various shipyards has been given considerable study by the Committee on Depreciation of the Atlantic Coast Shipbuilders' Association.

In the report prepared in 1918 by this Committee, the recommendations of which have already been adopted by the Association, there is included a complete discussion of the important elements and rates of depreciation.

The following paragraph, taken from this report, shows the important elements in depreciation which were considered by the Committee:

> "Shipyards must not only provide for the normal depreciation, that is, the depreciation due to wear-and-tear and obsolescence; but must also allow for the increase in this normal depreciation due to the increased time of use of plant and equipment through overtime operation; and are further faced with the necessity for amortizing the 'special depreciation' of those improvements which have been installed during the war, due to the war inflation of the labor and material mar-

ket existing at the time these improvements were carried out, and the special purpose of the improvements which will disappear in whole or in part on the termination of the war contracts."

The summary conclusions of the Committee, which have been adopted by the Association, are as follows:

"1st. That the straight-line method of charging off depreciation be adopted.

"2nd. That when possible the detailed classification of plant facilities given in Appendix "A" be adopted, together with the corresponding rates of normal depreciation stated in the last column of the table.

"3rd. That in cases where this detailed classification cannot be applied owing to lack of data or for other reasons, the more general classification indicated in the first column of the table may be adopted, with the corresponding rates.

"4th. That the normal rates of depreciation be increased to cover overtime depreciation, this increase being at a rate of 6¼% of the normal rate for each hour of overtime; all time in excess of the standard eight-hour day being considered overtime, in this connection. This rate of increase corresponds to 100% increase in normal rates when the plant is operated for the full 24 hours.

"5th. That a special depreciation reserve account be maintained by each company to which shall be credited the estimated special depreciation for all improvements undertaken while this country was at war and carried out at the contractor's expense, at a tentative rate of 20% of the expenditure for such improvements per year, for the calendar years 1918 and 1919; and that on December 31, 1919, an appraisal shall be made by a joint board for each yard and final adjustment made of the above reserve account.

"6th. That the rates here recommended for depreciation of all kinds be applied from January 1, 1918."

The list of rates of depreciation recommended by the Committee on Depreciation is reproduced in Appendix "A."

[redacted]

A clear interpretation of the difference between depreciation and amortization is included in the decision of the U.S. Treasury Department (Munitions Tax Law), Regulation No. 39, of October 24, 1916. This decision is reproduced in Appendix "B."

Charges for depreciation should be applied to the various departments on the basis of the value of buildings, machinery and equipment, and should be distributed to the job accounts or orders with the other fixed charge expense.

Basis of Expense Distribution and Application

For purposes of obtaining reasonably accurate and uniform distribution of expense to product units or job accounts, it is essential that the same general basis of distributing expense and applying such expense to the cost of product unit or job accounts be established in all shipyards.

At the present time both the method of distributing expense and applying same to production costs vary greatly in the different shipyards. Some of the shipyards do not assign expense to specific departments, but distribute their entire expense on a percentage plan. Other shipyards have established arbitrary percentages which are used for the charging of expense to job accounts or orders, and adjustments over or below the amount of expense which is so distributed are included at the end of each year as part of profit and loss.

Similar variations exist in the matter of the application of expense to the cost of product unit or job ac-

counts. Many of the shipyards use the direct labor cost method entirely. Some of the shipyards use the direct labor hour method, while still others combine the direct labor cost method with the machine rate cost method, particularly for those departments having large investments in machinery and equipment and where the labor costs are relatively unimportant. Still others use the combination of material and labor costs as the basis for the application of expense.

While no one basis for the distribution or application of expense to the product will give absolutely accurate results, and this applies particularly to the shipbuilding industry, where expense items vary considerably according to the different activities and products, it is essential that standard basis and methods be established in the distribution and application of expense to product costs, if proper comparisons are to be made and reasonably accurate results in applying expense are to be obtained.

Predetermination of Expense

In certain industries, where the work consists of definite and regularly continuing processes, it is desirable both for simplicity and accuracy to predetermine the various expense costs and to apply same to the direct costs of products or jobs on a proportional basis.

The variations in character and amount of output, as well as in the activities in the different shipyards, will not permit of accurate predetermination of all expense, the possible exception being the fixed charge expense.

Distribution of Expense

The uniform method which should be used in distributing expense to the product units or job accounts includes the following main steps:

(a) All items of indirect costs or expense, for any period in question, falling under the respective expense classifications, should be assigned to the respective departments or to the non-departmental expense accounts.

(b) The total expenses which are directly or indirectly attributable to the operation of each of the general works distributive departments should then be distributed over the other departments on the basis of the amount and character of services furnished.

(c) The total productive departmental expense (and the auxiliary and stock manufacturing expense) in the respective production departments should be distributed to each product unit or job account.

(d) The total expense of the general works departments and the proper proportion of the general administrative expense which is chargeable to production costs and the auxiliary and stock manufacturing departments, should be distributed to the product unit or job accounts, through the respective productive departments or auxiliary and stock manufacturing departments.

(e) In the case of shipbuilding companies having more than one yard, the central general administrative expense which is chargeable to production should be apportioned to each plant.

In those cases where there are no auxiliary and stock manufacturing departments, the method of expense dis-

tribution will be simplified to that extent, as it will not be necessary to assign parts of the general works expense and general administrative expense to such activities.

Application of Expense

With the distribution of the various expense items to productive departments (and such auxiliary and stock manufacturing departments as may exist) a uniform basis for the application of such expenses to the product units or job accounts should be used.

The following basis is suggested for use in the application of expense in all shipyards:

(a) The total cost of such of the general works distributive departments, such as the cost for power, light and heat service, etc., should be apportioned to the various departments on the basis of the actual service or benefit received by each department. Where it is possible, the distribution should be made according to meter readings or floor space used. Where meters are not installed, estimates of the horsepower used by various machines, wattage of lamps for light service, the floor space occupied for heating, etc., should be used.

(b) The general works expense should be distributed to the productive departments (and to such auxiliary and stock manufacturing departments as may exist) on the basis of the total labor cost in the particular period in each operating department. After such general works expense has been distributed to the respective departments, it should be applied to the product units or job accounts on the basis used for the application of productive departmental expense, namely, direct labor hours.

[redacted]

(c) The basis suggested for use in the distribution and application of general works expense should be used for the distribution and application of the general administrative expense. This applies to both the case of distribution of central general administrative expense to the individual plants, and to the distribution of the general administrative expense of any one plant to the productive departments and to the product units or job accounts of the individual plants.

(d) The productive departmental expense (as well as auxiliary and stock manufacturing expense to their respective products) should be applied to the product units or job accounts on the basis of direct labor hours.

SECTION VII

CONSIDERATIONS IN DEVISING STANDARD METHODS

Purposes Underlying Standard Methods

The plan of uniform cost methods has been developed with the threefold purpose of—

1. Providing standard methods by which the cost of the material, labor and expense items may be collected and ascertained for each definite product unit, job account, ship contract or vessel.

2. Providing standard methods for compiling and interpreting current statistics relating to progress and cost of production in the main divisions of steel ship manufacture and construction.

3. Providing uniform methods by which comparisons may be made with standards of performance and by which the executive will be able to visualize operating and production conditions and costs.

The attainment of these purposes must be characterized by the requirements which are set forth in the introduction of this report, which include the following:

(a) Accuracy.
(b) Timeliness.
(c) Uniformity of Terminology.
(d) Uniformity of Cost Classifications.
(e) Uniformity in Expense Distribution.
(f) Standard Basis for Estimates.
(g) Definite Standards of Comparison.
(h) Standard Instructions and Procedure.
(i) Control of Stores and Labor.
(j) Cost Organization.

Compilations of the money values according to the above requirements will make possible the accomplishment of the purpose first above set forth. The other two purposes will be attained in the use of the cost accounting machinery in gathering and interpreting statistics of production.

General Methods of Cost Keeping

Broadly considered, there are two general methods of ascertaining and compiling costs. One of these is generally referred to as the "process method," and consists of the gathering and compiling of costs by processes. The cost of any product unit or article is equal to the total of the direct and indirect costs and expenses incurred in the processes through which the product passed. The "process method" of cost accounting is particularly applicable where the product is standardized and production consists of a series of definitely measured complete processes or operations.

The other general cost finding method is that referred to as the "job order method." When this method is used, cost charges are ascertained and applied against specific product units or jobs. The "job order method" is applicable where the product is not standardized; where the work varies considerably with different orders, or where the production does not consist of a series of standard recurring processes.

Of the two general methods, the "job order method" is clearly the standard method which can best be applied to the various activities in the shipbuilding industry. In a general way the "job order method" is the one

[redacted]

which is at present in use in most of the shipyards, although there are many variations from the standard methods recommended.

The proposed uniform methods of cost finding for shipbuilding are briefly summarized as follows:

1. Costs are ascertained and compiled for every type and class of work which is done in a shipyard through the several series of production orders, shown in Section VIII, "Production Orders—Classification and Methods."

2. Costs are obtained and compiled for each of the product units through the different job accounts, as shown in Section IX, "Ship Product Units—Classification and Methods." Thus the cost of a production order is the sum of the cost of the product units.

3. The cost of each product unit is ascertained and compiled under the three main elements of cost, namely: direct labor and direct material charged directly to the product unit and expense apportioned to it. The methods applying to and the classification of each of these elements are shown in Sections XI, XII and XIII.

4. For purposes of compiling and proving direct charges and uniform expense cost to production and securing control over all costs, definite departmental divisions and designations are used as shown in Section X, "Ship Works Departments—Classification and Methods."

5. Costs are treated with definiteness and uniformity through standard classifications of the controlling divisions.

6. Definite cost figures under each of the job accounts

[redacted]

or product units supply standards for use in estimating and measuring production progress and operating efficiency.

7. Control of all work in process and stores through the general ledgers.

SECTION VIII

PRODUCTION ORDERS—CLASSIFICATION AND METHODS

Purpose, Use and Basis of Classification

In addition to ship production work in a shipyard, there are a number of other activities upon which costs must be ascertained separately. The classification of production orders includes all the distinct shipyard activities, and distinguishing series of order numbers constitute the method of identifying these different classes of work.

Each order authorizing work is given a production order number by which that job is thereafter known and distinguished from all other orders. The production or job order numbers will facilitate in comparing all the elements of costs, in tracing the costs which are applicable to any job or contract and in classifying the production work done in the shipyard.

The main series of shipyard production orders are set forth below and should be applicable to any shipyard. This series may be amplified or reduced without affecting the general plan. Whenever a block of numbers is used up a new block of numbers can be assigned.

Production Order Classification and Definitions

Following is the classification of the main classes of production orders and the definitions of each class:

1— 999. Construction Orders—Ships.

1,000—1,999. Construction Orders — Ship Product Stock.
2,000—2,999. Construction Orders — Special Contracts.
3,000—3,999. Auxiliary and Stock Manufacture Orders.
4,000—4,999. Defective Work Orders.
5,000—5,999. Vessel Repair Orders.
6,000—6,999. Construction and Betterment Orders — Plant and Equipment.
7,000—7,999. Repairs and Maintenance Orders — Plant and Equipment.
8,000—8,999. Miscellaneous Orders (work for others).

1. *Construction Orders—Ships*, will be used on all orders for the production of a ship entire, including the steel hull, machinery, and finishing and outfit.

2. *Construction Orders—Ship Product Stock*, will be used for all orders for the production of ship materials, parts or equipment (other than by auxiliary and stock manufacture departments) where the product is to go into stock.

3. *Construction Orders—Special Contracts*, will be used for all special orders of ship production where only parts of the entire ship or all work of special ship construction are included.

4. *Auxiliary and Stock Manufacture Orders* will be used for all orders for work by auxiliary and stock manufacture departments.

5. *Defective Work Orders* will be used for all orders in connection with defective work or for correction of defects in any article or products manufactured.

6. *Vessel Repair Orders* will be used for all orders for ship repair work.

7. *Construction and Betterment Orders—Plant and Equipment*, will be used for all orders for new construction or betterments on plant or equipment, which improvements are permanent in nature and add to the capital investment of the plant.

8. *Repairs and Maintenance Orders — Plant and Equipment*, will be used for all orders on general repair and maintenance work on buildings, machinery, equipment, fixtures or tools, which work does not affect the capital investment of the plant, the cost of which work is either charged to depreciation reserve or is a part of productive, general works or general administrative expenses.

9. *Miscellaneous Orders* will be used for all production orders (for material, labor and expense) for others not included in any of the above.

Symbol Codes

In the preparation of the different classifications, symbol codes have been set up which will be used to designate the respective items wherever they are used in the making of reports, etc. The use of symbols reduces the amount of writing necessary in making out labor reports, material requisitions, etc. Such codes or symbols will also lend themselves readily to mechanical sorting and tabulation, which mechanical devices are already being used in many of the shipyards for purposes of gathering and compiling payrolls, labor cost distribution and material control.

The decimal system of symbols which has been used in the classifications which follow consists of applying

vision, namely, "Structural Hull Manufac
11; the sub-classification of this sub-c
mely, "Structural Hull—Steel and Iron
is numeral, 111, is the symbol for the Str
Steel and Iron Group, of the Structural
cture Section of the Manufacture of Shi
ion.

In making out time cards, material requi
lers, etc., it will be necessary to use in con
e job account number the production or jol
r, the department number or machine num
int symbol, where there is more than one p
g to one company.

SECTION IX

SHIP PRODUCT UNITS—CLASSIFICATIONS AND METHODS

Relation of Product Units to Production Orders

Classification

Under each class of production orders there are the product units upon which complete costs should be gathered, and to which charges should be made for material, labor and expense costs. It is thus seen that the cost for any particular production order is the sum of its product units.

There are now considered the product units applicable to each class of orders.

Steel Ship Product Units

The steel ship product units constitute the product units which are applicable to all of the divisions of ship construction and repair. The same product units which are provided for orders on construction of ships are also applicable to ship product stock orders; construction orders for special contracts; defective work orders, and vessel repair orders.

Auxiliary and Stock Manufacture Product Unit

The product units which are applicable to production in the Auxiliary and Stock Manufacture Departments are the products of the respective auxiliary and stock manufacture departments.

cellaneous Orders Product Units

'he product units applicable to miscellane depend upon the character of the particu :never possible, the classification of proc l for the other production orders series . for miscellaneous orders.

l Ship Product Units

Applicable to Construction Orders—Ship; Orders—Ship Product Stock; Constructi pecial Contracts; Vessel Repair Orders; a Work Orders.)

he classification of steel ship product unil controlling accounts to which all charges with material, labor and expense costs wil

iarges are made for material against the

in the labor classification. The labor hours and costs for each of the more important labor operations for each steel ship product unit can thereby be ascertained.

Proper percentages of expenses are charged to each steel ship product unit based upon the expense items appearing under the expense classifications. Part of these expenses are departmental and part are non-departmental and such expenses are applied to the product units on the definite basis described in Section VI, "Principles and Specific Definitions—Expense."

As indicated in the first part of this report, a clear distinction is made in the classification of ship product accounts, between the division of manufacture of ship parts, and the division of ship construction and machinery and outfit installation. This makes it possible to ascertain separately the costs of manufacturing ship parts, and the cost of assembling, erecting and installing parts and outfit into the vessel.

Basis of Divisions

Under each of these two principal divisions are included three main subdivisions, as follows:

1. Structural Hull.
2. Machinery.
3. Hull Finishing and Outfit

In addition to these main subdivisions there is included under the main division of ship construction and machinery and outfit installation a group of accounts which cover the direct charges which are of general character. These are hereafter referred to as Direct General Charges.

1. *Manufacture of Ship Parts.*
   11. Structural Hull Manufacture.
   13. Machinery Manufacture.
   15. **Hull Finishing and Outfit Manufactu**
   17. **Auxiliary and Stock Manufacture.**
2. ***Ship Construction and Machinery and O***
   lation.
   21. **Structural Hull Erection and Const**
   23. **Machinery Installation.**
   25. **Hull Finishing and Outfit.**
   27. **Direct General Charges.**

he term *Structural Hull* consists of the y of a vessel exclusive of machinery, engi finishing, defined in what follows:

he term *Structural Hull Manufacture* i k and operations involved in the fabricat ing or other work tending to put raw m ponent parts into a state where such parts ship construction. This section does not k and operations involved in the manufactu

use in the complete installation of all engines, turbines and machinery entering into the hull proper. It also includes the assembly of the parts of an engine or machine into completed engines or machines.

The term *Hull Finishing and Outfit Manufacture* includes all work and operations involved in the manufacture of raw materials and parts into a state where such items are ready for vessel use and installation, as indicated under the subdivision of "Hull Finishing and Outfit Manufacture."

The term *Structural Hull Erection and Construction* includes all work and operations involved in the erection and construction of the structural hull of a vessel.

The term *Machinery Installation* includes the work of installing and fitting all engines and machinery items into a vessel.

The term *Hull Finishing and Outfit* includes the work of fitting out, finishing and outfitting the vessel with the parts and articles indicated under the subdivision of "Hull Finishing and Outfit."

The term *Direct General Charges* includes the charges which are general in character and which can be applied directly against a ship contract, but are not allocable to any one of the other main divisions.

Special Notes on Classification

The main divisions of the ship product units classification include the divisions and items which are applicable to ordinary merchant ships. In those cases where special designs are required, as for naval ships, addi-

111. *Group.*

1111. *Part.*

ach of the main divisions consists of sec
ıg character or class of job. Each secti
groups indicating arbitrary divisions of ε
ctural parts or types of engines, machin

Each group in turn consists of a number
es or parts which when assembled with o
e the group or product unit.

Vhere such records are desired, the part or
therefore, consist of a division number,
ıber, a group number and a part number.
, each of the parts or pieces will be giv
ıber according to sequence and use.

'he job accounts as given in the main cl
uch subsidiary divisions as may be desir
basis of the outlines for cost summarie
nates on production, as well as the basis fo
work completed.

Detailed Product Unit Classification

Following is the suggested classification of main ship product units:

1. *Manufacture of Ship Parts.*
   11. *Structural Hull Manufacture.*
       111. Structual Hull—Steel and Iron.
       112. Structural Hull — Structural Castings, Forgings and Rudder.
       113. Scrap in Steel Hull Manufacture.

Each of the above groups may be divided into units indicating individual parts or pieces of structural steel materials going into the steel hull. An alphabetical list of such parts will be of help in this connection.

   13. *Machinery Manufacture.*
       131. Main Engines and Turbines (includes condensers and propeller shafting and bearings).
       132. Main Boilers, Auxiliary Boilers, Mountings and Attachments.
       133. Pumps, Tanks and Auxiliary Machinery which are a necessary part of the propelling machinery on the ship.
       134. Piping (includes all piping which is in any way connected with the propelling machinery or its auxiliaries).
       135. Miscellaneous Machinery and Engine Room Fittings.
       136. Electrical Apparatus.
       138. Scrap in Machinery Manufacture.
       141. Hull Machinery (including windlass, winches, capstans, warping winches, steering engine and ballast pumps, etc.).
       142. Hull Piping (includes .ballast and bilge piping, sounding and air pipes, water lines, steam smothering pipes, etc.).

When it is desired to ascertain and apply costs in greater detail, each of the above sections will be divided

(does not include machi
covered by Hull Machiner

155. Boats, Life Rafts and Davits

158. **Furniture, Fixtures and]**
Cabin and Galley Equipm

159. **Standard Master's, Stewar**
ter's, Boatswain's, etc., Ou

160. **Miscellaneous Finishing anc**
included in the above.

161. **Scrap.**

2. ***Ship Construction and Machinery a***
stallation.

21. ***Structural Hull Erection and C***

211. **Structural Hull.**

218. **Scrap.**
(See Note under Account 1
Hull Manufacture.)

23. ***Machinery Installation.***

231. **Main Engines and Turbi**
condensers and propeller
bearings).

232. **Main Boilers, Auxiliary Bo**
ings and Attachments.

236. Electrical Apparatus.
238. Scrap in Machinery Installation.
241. Hull Machinery (including windlass, winches, capstans, warping winches, steering engine and ballast pumps, etc.).
242. Hull Piping (includes ballast and bilge piping, sounding and air pipes, water lines, steam smothering pipes, etc.).
(See Note under Account 13—Machinery Manufacture.)

25. *Hull Finishing and Outfit.*
251. Steel Hatches, Cargo Ports, Scuttles and Doors.
252. Light and Ventilation.
253. Masts, Derricks and Rigging.
254. Warping, Towing Gear and Fittings (does not include machinery, which is covered by hull engineering).
255. Boats, Life Rafts and Davits.
256. Carpentry and Joinery.
257. Painting, Varnishing and Cementing.
258. Furniture, Fixtures and Miscellaneous Cabin and Galley Equipment.
259. Standard Master's, Steward's, Carpenter's, Boatswain's, etc., Outfits.
260. Miscellaneous Finishing and Outfit (not included in the above).
261. Scrap.
262. Miscellaneous Supplies, Stores and Chandlery.

27. *Direct General Charges.*
271. Insurance and Classification Fees.
272. Staging, Shoring and Fairing (includes labor and material, salvage value to be credited).
273. Testing and Inspection.
274. Dry Docking.
275. Tug Hire, Mooring and Shifting.
276. Launching and Entertainment.

277. Trials and Delivery.
278. Miscellaneous Direct General Charges (not included in the above).

Auxiliary and Stock Manufacturing Product Units

Related to the steel ship product units are the products manufactured by auxiliary and stock manufacturing departments, the cost of which cannot be charged directly against ship construction and production.

The operations of the iron foundry, the brass foundry, the paint factory, and such other auxiliary and stock manufacturing departments should be accounted for separately from the operations of the other production departments. Separate accounts should be maintained of the cost of direct and indirect labor, materials, fuel and other supplies, as well as all expense of any kind connected with and occasioned incidental to such production. The products of these departments will be invoiced to stores in a manner identical to the treatment given to materials purchased from the outside.

For the auxiliary and stock manufacture products, the costs should disclose the cost per unit, where the product is of the same general type. In those cases where the product varies the cost per job should be the figure used.

No attempt will be made here to provide systems of cost-keeping for all auxiliaries which may exist in the shipyards. The principles and general methods proposed for ship production will apply with equal force to the auxiliary production departments. The one thing

which should characterize all methods is that they should disclose the unit costs whatever the unit is, and that they should represent the whole cost. The article produced is the product unit and to it all charges of labor, material and pro rata share of all expenses should be made.

Foundry Cost Accounting Methods

The standard foundry cost system proposed by the American Foundrymen's Association (Incorporated), of Chicago, provides detail methods for foundry cost accounting. The cost methods proposed therein are now in use in a number of foundries throughout the country.

In line with the purposes of this study, it is suggested that, in so far as it is practicable, the major recommendations and methods for foundry cost accounting as included in the Standard Foundry Cost System of the American Foundrymen's Association should be adopted by those shipyards where foundry manufacture comprises one of the activities of the shipyard.

Other Auxiliary and Stock Products

For each of the other stock manufacturing departments it will be necessary to have individual product units for collecting and analyzing costs. The methods should follow the general outline for ship production cost; charging labor and material direct, departmentalizing the production department expense, and treating other expenses as discussed for ship production under Section VI, "Principles and Specific Definitions—Expense."

Construction and Maintenance Product Units

The job account or product units which should be used in connection with plant construction and maintenance is that of the individual items shown in the classification of fixed assets. The purpose of this is to show the total cost of construction, betterments or repair jobs on buildings, equipment or machinery.

The classification of fixed assets follows the "Classification of Buildings and Equipment," which is included in the Report on Depreciation by the Atlantic Coast Shipbuilders' Association. It has been amplified to include those fixed asset items on which depreciation is not figured. Thus the classification which is used as a product unit classification for plant maintenance and construction orders will also be used for depreciation and for purposes of making up the balance sheet.

Detailed Classification of Fixed Assets

1. *Land and Structures.*
    11. *Land.*
    12. *Buildings.*
        121. Stone, brick, concrete, with or without steel, steel frame and masonry curtain wall buildings.
        122. Steel with corrugated sheet iron or steel plate.
        123. Steel or corrugated sheet iron with wood.
        124. Power plant buildings.
        125. Wood buildings.
    13. *Piers, Bulkheads, Wharves and Docks.*
    14. *Launching Ways (Fixed Structures).*
        141 Wood.
        142. Concrete.
    15. *Water Tanks and Steel Stacks.*

16. *Shipways, Dry Docks and Basins.*
    161. Masonry or Concrete.
    162. Wood.
17. *Concrete and Brick Bins, Fences and Miscellaneous Concrete and Brick Structures.*
18. *Wood Bins, Fences, Racks and Other Wood Structures.*

2. *Power Machinery.*
    21. *Electric Generators, Switchboards and Power House Equipment, Boilers and Boiler House Equipment* (including Economizers, Feed Water Heaters, Injectors, Stacks, Uptakes, etc.).
    22. *Engines, Gas and Oil.*
    23. *Engines, Steam* (including Pile Drivers, Hoisting Engines, Compressors, Air Pumps, Vacuum Pumps, etc.).
    24. *Pumps, Water Supply, Feed Water, Fire, etc.*
    25. *Electric Motors and Controllers.*
    26. *Coal and Ash Conveyors.*

3. *Shop Machinery and Tools.*
    31. *Hydraulic Forging Presses, Bending Presses and Fluid Compressors.*
    32. *Hammers, Steam, Drop or Helve.*
    33. *Machine Tools, Lathes, Slotters, Planers, Boring Mills, Drilling, Boring and Milling Machines, etc.*
    34. *Miscellaneous Shop Machinery and Equipment (including Small Scales, Spare Parts, etc.)*
    35. *Woodworking Machinery.*
    36. *Small Tools.*

4. *Cranes, Elevators, etc.*
    41. *Cranes, Electric, Hydraulic, Steam and Hand Power, Jib and Davit; Hand, Electric or Air Hoists, Derricks, Lifting Magnets and Charging Machines.*
    42. *Locomotive Cranes, Steam and Electric.*
    43. *Elevators.*
    44. *Craneways.*

[redacted]

45. *Portable Pneumatic, Electric and Hydraulic Tools; Portable Hand, Electric, Hydraulic or Pneumatic Hoists and Lifting Devices; Small Jib Cranes.*

5. *Furnaces and Forges.*

51. *Heating, Treating and Annealing Furnaces, Brass Foundry, Melting Furnaces, Oil Furnaces, etc.*

52. *Blast Furnaces, Stacks and Stoves, Soaking Pits, Open Hearth and Crucible Melting Furnaces, Cupolas, etc.*

53. *Formers and Drop Forge Dies.*

6. *Other Equipment.*

601. Railroad Tracks, including Rails, Ties, Ballast, Excavations, Grading, etc.
602. Trestles.
603. Bridge and Retaining Walls.
604. Marine Railways.
605. Fire Systems and Apparatus.
606. Piping and Wiring; Piping for Steam and Exhaust Air, Oil, Gas and Water Lines; Pneumatic and Hydraulic Transmission, Electric Light and Power Systems, Wiring, Feeder and Other Outside Wiring, including Poles.
607. Heating and Ventilating Systems, Drying Apparatus.
608. Sanitary and Water Supply Systems, Sewers and Drainage Systems.
609. Floating Equipment, Barges, Boats, Scows, Motorboats.
610. Portable Launching Ways.
611. Floating Dry Docks.
612. Stable and Garage Equipment.
613. Motor Trucks and Automobiles.
614. Locomotives, Steam and Electric.
615. Cars used by Transportation Department.
616. Scales, Large.
617. Water Purifier.
618. Pickling Tanks, etc.



7. *Furniture and Fixtures.*
   (Includes Office Equipment, Shop, Yard, Store Tool Room Fixtures, Typewriters, Adding Machines, etc., Lockers, Wardrobes, etc.)
8. *Patents and Royalties.*
   81. *Drawings and Patterns.*
   82. *Patents and Royalties.*

Miscellaneous Orders Product Units

Whenever an order is placed which falls under the series of Miscellaneous Orders, it should be analyzed into product units similar to those appearing under the Ship Construction Product Unit Classification. To each such unit all material and labor should be charged directly, and the expense apportioned upon the basis recommended in other cases.

SECTION X

SHIP WORKS DEPARTMENTS—CLASSIFICATION AND METHODS

Relation of Departmental Classification to Product Units, Labor and Expense

It has been shown how the departmental classification is subsidiary to the ship product unit classification. Charges are made to the job account or product unit for labor, material and expense. The direct labor charges against the job accounts are reported through the departments and labor charges thus secured are used as the basis for distribution of expense to the various job accounts or product units.

The departmental classification has its greatest use in connection with distributing and applying expense costs to the product units or job accounts. In so far as it is possible, all expense charges should be assigned to departments for accuracy in expense distribution and as a means of operation control.

The basis and methods of distributing and applying expense through the departments of the job accounts or product units are set out in Section VI, "Principles and Specific Definitions—Expense."

Basis of Departmental Classification

The departmental classification includes the typical departmental divisions which are ordinarily found in a shipbuilding organization. The divisions and titles of

departments will vary in different shipyards, but the general layout should be applicable to any shipbuilding company.

In those cases where there are more than one ship works, each plant will be given a separate plant number or other distinctive code designation, and this designation will be used with the departmental code designation for reporting and ascertaining costs and for proper expense distribution. In those yards where certain activities are not carried on or where departments are under different jurisdictions, changes can be made in the classification without affecting the general classification plan and the main divisions.

The main divisions of the departmental classification are as follows:

1. Productive Departments.
2. General Works Departments.
3. General Works Distributive Departments.
4. Auxiliary and Stock Manufacturing Departments.
5. General Administrative Departments.

Definitions of Main Divisions

1. The *Productive Departments* include those departments of a plant which do the actual work in producing parts and articles for ship construction or in erection, assembling or installation of parts in ship construction or vessel repair work. These departments are often referred to as the operating departments.

2. The *General Works Departments* include those non-productive departments which are identified with a particular plant, except those departments included under the classifications which follow.

3. The *General Works Distributive Departments* include those departments which furnish services which are measurable and in which the expense of operation can be charged directly to productive and other departments upon the basis of the amount of service rendered.

4. The *Auxiliary and Stock Manufacturing Departments* include those departments which produce articles and materials which cannot be charged directly against ship construction. The products of these departments are invoiced to stores in the same manner as are the materials purchased.

5. The *General Administrative Departments* include those departments which have to do with the general administration of the company's affairs.

Notes on Departmental Classification

In those shipbuilding companies having more than one works or shipyard, the administrative departments at each plant should, for organization purposes, be considered as branches of the central departments. Where administrative departments in a plant have such functions as place them under the jurisdiction of central departments, the former departments should have the same titles and code designations as the latter, with proper plant designations to distinguish the departments for each plant.

The distinction which is made in this classification between the general administrative departments and general works departments is clear in a shipbuilding company having more than one works. In those shipbuilding companies having but a single works, where the general

administrative departments are not distinct from the general works departments, it is suggested that the various administrative departments be considered as works departments, except the following, which should be considered as general administrative departments in any case:

501. President—office and general.
502. Vice-President—office and general.
503. General Manager—office and general.
504. Legal Department.
505. Treasury Department.
518. Sales Department.
519. Branch Offices.

Detailed Departmental Classification

The following is the detailed classification of typical departmental divisions of a shipyard organization:

1. *Productive Departments.*
   - 101. Mold Loft and Templet Shop.
   - 102. Pattern Shop.
   - 103. Plate and Angle Shop.
   - 104. Cutting and Welding Shop.
   - 105. Anglesmith and Blacksmith Shop.
   - 106. Bolting Department.
   - 107. Shipfitting Department.
   - 108. Erecting Department.
   - 109. Drilling and Reaming Department.
   - 110. Riveting Department.
   - 111. Chipping and Caulking Department.
   - 112. Sheet Metal Shop.
   - 113. Coppersmith Shop.
   - 114. Boiler Shop.
   - 115. Machine Shop (Hand).
   - 116. Machine Shop (Power).
   - 117. Mason Shop.
   - 118. Carpenter Shop.
   - 119. Joiner Shop.
   - 120. Plumber Shop.

121. Pipe Shop.
122. Electric Shop.
123. Electroplating Department.
124. Galvanizing Shop.
125. Paint Shop.
126. Cement Department.
127. Rigging Loft.
128. Shipwright Shop.
129. Boat Shop.
130. Fitting-Out Basin.
131. Dry Docks.
132. Shipways.

2. *General Works Departments.*

201. Works Executive Office—General Works Manager.
202. Hull Superintendent—Office and General.
203. Machinery Superintendent—Office and General.
206. Accounting Department.
    2061. Accounting and Bookkeeping Bureau.
    2062. Cost Bureau.
    2063. Time Keeping and Payroll Bureau.
207. Purchasing, Stores and Traffic Department.
    2071. Purchasing Bureau.
    2072. Stores and Stores Records Bureau.
    2073. Salvage Bureau.
    2074. Traffic Bureau.
208. Engineering and Drafting Departments (Hull and Engine).
209. Production Engineering Department.
210. Employment, Welfare, Safety and Sanitation Department.
211. Fire, Police and Watchmen Department.
212. Yard Maintenance Department (includes yard laborers and labor foremen).
213. Tool Department.
214. Floating Equipment Department.

3. *General Works Distributive Departments.*

301. Power, Heat and Light Departments.
302. Gas Manufacturing Department.



303. Water Department.
304. Pneumatic Power Department.
305. Hydraulic Power Department.
306. Yard Switching Department.
307. Stable Department.
308. Garage and Auto Truck Department.

4. *Auxiliary and Stock Manufacturing Departments.*
401. Iron Foundry.
402. Brass Foundry.
403. Steel Foundry.
404. Paint Manufacture Department.
405. Bolt and Rivet Manufacture Department.

5. *General Administrative Departments.*
501. President—office and general.
502. Vice-President—office and general.
503. General Manager—office and general.
504. Legal Department.
505. Treasury Department.
506. Central Accounting Department.
507. Central Purchasing, Stores and Traffic Department.
508. Central Engineering and Drafting Department.
509. Production Engineering Department.
510. Employment, Welfare, Safety and Sanitation Department.
518. Sales Department.
519. Branch Offices.

SECTION XI

MATERIALS AND SUPPLIES—CLASSIFICATION AND METHODS

Purposes and Use of Classification

Costs must be classified according to the different elements of costs as well as according to the product units and departments. The main items falling under the element of material costs have been set up under the classification of materials and supplies. This classification includes the main material and supply divisions, which will be used by the engincering or production department; by the purchasing, stores and traffic department, and by the accounting department in connection with the preparation of bills of material, purchasing, receiving, storing, issuing, pricing, inventorying and assembling of material costs, and will serve as the basis for analyzing materials which are in work in process.

The keeping of the material cost records will be of value in connection with the following:

(a) Basis for estimating and for preparing bills of material.
(b) Basis for comparing quantities of particular items going into specific product units with standards.
(c) Making sure that all materials entering into a product have been accurately charged.
(d) Computing and analyzing material charges.
(e) Ascertaining the degree of completion on any job.
(f) Checking waste or excess amounts of any particular material entering into a product unit.

Definitions of Main Divisions

The main divisions of the materials and supplies classification are as follows:

1. Material.
2. Parts.
3. Structural Units Complete.
6. Supplies.

The definitions of the main divisions are as follows:

1. *Materials* include unfabricated stuffs or simple objects which enter into structures, equipment, hull machinery or outfit, but which are not restricted to specific uses.

2. *Parts* include fashioned objects, which, when attached to or assembled with other parts, lose their individual identities in the formation of structures, machines or more complicated mechanisms.

3. *Structural Units Complete* include complete items of product units ready for installation in a ship as given in the "Classification of Product Units for Ship Construction."

6. *Supplies* include commodities which after first use show material change in or an appreciable impairment of the physical condition; or items of minor equipment having small value or short life.

Detailed Material and Supplies Classification

1. *Materials.*
   11. *Raw Materials.*
   12. *Metallic Materials* (exclusive of steel conduit and steel conduit fittings).
       121. Metal in Pigs.
       122. Cable and Wire Rope.
       123. Chain.
       124. Pipe and Pipe Fittings.

13. *Building and Street Surfacing Material* (excluding lumber and metallic materials).
14. *Lumber.*
15. *Fibre Products and Insulation Materials.*
16. *Paints, Varnishes and Glass.*
18. *Scrap.*
19. *Miscellaneous Materials* (not included in any of the above).

2. *Parts.*
   21. *Building and Cabinet Making Parts.*
   22. *Motor Vehicle and Motor Boat Parts.*
   23. *Structural Iron and Steel.*
      231. Structural Steel and Iron.
      232. Structural Castings and Forgings.
      233. Other Castings and Forgings.
   24. *Engine and Machine Parts and Protection Attachments.*
   25. *Electrical Parts.*
   26. *Valves and Valve Parts.*
   29. *Miscellaneous Parts* (not included in the above).

3. *Structural Units Complete.*
   33. *Engine and Machinery Items.*
      331. Main Engines and Turbines (includes Condensers and Propeller Shafting and Bearings).
      332. Main Boilers, Auxiliary Boilers, Mountings and Attachments.
      333. Pumps, Tanks and Auxiliary Machinery which are a necessary part of the propelling machinery on the ship.
      334. Piping (includes all piping which is in any way connected with the propelling machinery or its auxiliaries).
      335. Miscellaneous Machinery and Engine Room Fittings.
      336. Electrical Apparatus.
      341. Hull Machinery (includes windlass, winches, capstans, warping winches, steering engine and ballast pumps, etc.).

[redacted]

342. Hull Piping (includes ballast and bilge piping, sounding and air pipes, water lines, steam smothering pipes. etc.).

35. *Hull Finishing and Outfit.*

351. Steel Hatches, Cargo Ports, Scuttles and Doors.

352. Lighting and Ventilating Equipment.

353. Masts, Derricks and Rigging.

354. Warping, Towing Gear and Fittings (does not include machinery, which is covered by Hull Machinery.

355. Boats, Life Rafts and Davits.

358. Furniture, Fixtures and Miscellaneous, Cabin and Galley Equipment.

359. Standard Master's, Steward's, Carpenter's, Boatswain's, etc., Outfits.

360. Miscellaneous Finishing and Outfit (not included in the above).

6. *Supplies.*

61. *Fuel.*

611. Coal, Coke, Charcoal and Wood.

612. Liquid Fuels and Illuminants.

62. *Lubricants.*

63. *Mechanical, Plant and Electrical Supplies.*

631. Mechanical and Plant Supplies.

632. Electrical Supplies.

633. Motor Vehicles and Motor Boat Supplies.

64. *Chemicals and Laboratory, Medical and Photographic Supplies.*

65. *Office and Drafting Supplies.*

66. *Cleaning and Toilet Supplies.*

67. *Forage and Other Supplies for Animals.*

68. *Food and Household Supplies.*

69. *Miscellaneous Supplies* (not included in any of the above).

Material Methods

As indicated under Section 4—"Principles and Specific Definitions—Materials," it is essential for adequate

cost accounting to have centralized stores control of all the materials in ship production.

The various steps in connection with material control, beginning with the obtaining of a contract or order; the making of the purchase requisition through the stores department; the issuing of the purchase order and the setting of the price on the cost of the order by the purchase department; the receiving and storing of material in different stores (depending upon the character and use of the material); the issuing of materials; and the inventorying of material in stock and in process—all these should fall under the supervision of a well organized purchasing stores and traffic department having centralized control over all materials in the shipyard.

With proper centralized stores control, the accounting of costs of material and supplies present no particular difficulties as each transaction is directly traceable to a specific job account or a departmental use.

Different methods of stores-keeping are employed in different yards, but generally stores divide themselves into two main divisions: (1) general stores and (2) contract stores.

Under general stores are included all stock material and supplies which are not assigned to any definite or specific job. Under the general stores, there are such subsidiary stores as general supplies stores; fuel stores; paint stores, etc.

Under contract stores, are included materials, parts and equipment which are purchased, manufactured or taken from general stores for a specific job or product

unit. Charges for such contract materials should be made direct to the contract or job. The account charged is the product unit for which the material will eventually be requisitioned. When the material is requisitioned out of contract stores, it will not be charged to the product unit but record will be made of the issue. In case material which is charged against a specific product unit is used on another product unit of the same job order or on a product unit of another job order, a charge should be made against the product unit which used the material, and a credit made to the other product unit.

For adequate material control and for accuracy in the handling and charging of materials, it is essential, that prices be set by the purchasing department on the cost of the material at the time of the issue of the order and such prices be used in billing the material out of stores. Also perpetual inventories should be maintained for all stores. These inventories should at all times show the balance on hand, the amounts ordered and average costs. No material should be issued from stock except upon written requisition.

SECTION XII

LABOR—CLASSIFICATION AND METHODS

Purposes and Use of Classification

For the purpose of payroll preparation and distribution of labor costs, definite classifications and definitions of the different classes of labor and of the major labor operations are necessary.

The classifications of positions and occupations under main groups according to the character of work and under distinctive occupational titles, should be used as a basis for the preparation of payrolls and of statistics on wage changes, selection, labor turn-over, accidents and other employment conditions.

The basic units for labor costs in shipbuilding are the labor processes or operations. The distribution of labor costs according to the major labor operations will be used for purposes of cost control, estimating, comparing costs with standards and gauging the efficiency of classes of workers in the productive departments on the various jobs and for the plant as a whole.

Basis and Definitions of Main Labor Classes

The labor classification which appears below is drawn up on the basis of general character of work. Under each class there are included the different positions and occupations which are found in the average shipyard.

The main classes of the classification are as follows:

1. Executive, Administrative and Supervisory Class.
2. Professional Class.



3. Clerical Class.
4. Supervising Producing Class.
5. Skilled Trades Class.
6. General Labor and Miscellaneous Class.

The following definitions of the main classes will serve as a guide for the classification of occupations and positions:

1. *Executive, Administrative and Supervisory Class* includes those positions in which incumbents assume primary responsibility for the direction, supervision and control of the activities or work under their jurisdiction (except such positions as are specifically included in Class 4, the Supervising Producing Class).

2. *Professional Class* includes those positions in which incumbents perform work requiring training or experience in a recognized profession. (Executive and managing positions having direction of professional work should be included in the Executive, Administrative and Supervisory Class.)

3. *Clerical Class* includes those positions in which incumbents perform clerical work or service in connection with routine administrative office or related duties. (Executive and managing positions having general charge of such work should be included in the Executive, Administrative and Supervisory Class).

4. *Supervising Producing Class* includes the positions of Quartermen, Leading Men or Gang Leaders, and positions having similar supervising duties.

5. *Skilled Trades Class* includes those positions in which incumbents perform work in the different trades, handicrafts, or useful arts, or work requiring manual

or mechanical skill and experience. Positions having duties of the inspection of materials, of workmanship, or of special conditions should also be included under this class.

The occupations enumerated under the Skilled Trades Class correspond to those included in the decision of October 1, 1918, by the Shipbuilding Labor Adjustment Board (Macy Board). This list is subject to any subsequent rulings which have been made by the Macy Board.

Descriptions of the duties of the occupations listed are included in the "Handbook on Shipyard Occupations," published by the United States Shipping Board Emergency Fleet Corporation.

6. *General Labor and Miscellaneous Class* includes those positions in which incumbents perform routine, unskilled manual labor. This class should also include miscellaneous positions not covered in any of the above classes.

Detailed Labor Classification

1. *Executive, Administrative and Supervisory Class.*
   Includes the following:
   - Executive Officers and Staff Assistants.
   - Department Heads and their principal Assistants.
   - Superintendents and Assistant Superintendents.
   - Foremen.
2. *Professional Class.*
   Includes the following:
   - Accountants.
   - Architects, Engineers, Draftsmen and Copyists.
   - Analysts, Chemists, Pharmacists.

Lawyers.
Physicians, Dentists, Nurses.
Other Professional Employes (not included in the above).

3. *Clerical Class.*
Includes the following:
Billers.
Bookkeepers.
Card Punchers.
File Clerks.
Messengers.
Mimeographers.
Office Boys.
Office Machine Operators.
Stenographers.
Storekeepers.
Storeroom Clerks.
Storeroom Helpers.
Tabulating Machine Operators.
Timekeepers.
Typists.
Voucher Clerks.

4. *Supervising Producing Class.*
Includes the following:
Quartermen.
Leading Men.
Gang Leaders.

5. *Skilled Trades Class.*
Includes the following:
Angle and Frame Setters.
Anglesmiths, heavy fires.
Anglesmiths, heavy fires, Helpers.
Anglesmiths, other fires.
Anglesmiths, other fires, Helpers.
Backhandlers.
Bending Rollers.
Blacksmiths, heavy fires.
Blacksmiths, heavy fires, Helpers.
Blacksmiths, other fires.
Blacksmiths, other fires, Helpers.
Boilermakers.

[redacted]

Boilermakers' Helpers.
Bolters.
Boltmakers.
Boltmakers' Helpers.
Brakemen, Yard.
Bricklayers.
Bricklayers' Helpers.
Burners, First Class.
Burners, Second Class.
Burners' Helpers.

Cable Splicers.
Cable Splicers' Helpers.
Carpenters, First Class.
Carpenters, Second Class.
Carpenters' Helpers.
Casting Cleaners (Hand and Machine Chippers).
Cementers.
Cementers' Helpers.
Checkers, Material.
Chippers.
Chippers and Caulkers.
Chippers' and Caulkers' Helpers.
Chippers and Grinders.
Coke Handlers.
Conductors (Locomotive).
Conductors (Road Crane).
Coppersmiths.
Coppersmiths' Helpers.
Coremakers.
Coremakers' Helpers.
Counters.
Countersinkers.
Countersinkers' Helpers.
Cupola Tenders.
Cupola Tenders' Helpers.

Drillers (Pneumatic).
Drillers' Helpers.
Drop Forgers.
Drop Forgers' Helpers.

Electricians.



Electricians' Helpers.
Electric Welders.
Engineers (Electric).
Engineers (Locomotive).
Engineers (Steam).
Erectors.
Firemen.
Firemen (Locomotive).
Fitters.
Fitters' Helpers.
Flange Turners.
Flange Turners' Helpers.
Furnacemen on Shapes and Plates (Shipwork)
Furnacemen on Shapes' and Plates' Helpers.
Grinders.
Hammer and Machine Forgers, Heavy.
Hammer and Machine Forgers' Helpers
Hammer Runners, heavy.
Hammer Runners, other.
Heaters.
Heaters in Angle Work.
Heaters to Heavy Forgers.
Holders-On.
Hook and Chain Fasteners.
Hoisting and Portable Firemen.
Hosemen.
Inspectors, Fire.
Inspectors, Lumber.
Inspectors, Other.
Joiners.
Joiners' Helpers.
Layers-Out.
Layers-Out Helpers.
Levermen or Cranemen.
Levermen or Cranemen Helpers.
Liner Forgers.
Liner Forgers' Helpers.
Linermen.
Linermen's Helpers.
Loftsmen.

Loftsmen's Helpers.
Machinemen (Lumber).
Machinemen's Helpers (Lumber).
Machinists, First Class.
Machinists, Second Class.
Machinists' Helpers.
Mangle Rollers.
Marine Erectors, First Class.
Marine Erectors, Second Class.
Marine Erectors' Helpers.
Metal Polishers.
Metal Polishers (Buffers and Platers).
Moulders.
Moulders' Helpers.

Oilers.
Offsetters.
Operators of Aerial Hoists, Single and Double Cableways, etc.
Operators of Non-Hoisting Donkeys and Winches.

Packers.
Painters and Polishers.
Painters' and Polishers' Helpers.
Painters, Bitumastic.
Passers (Rivets).
Passer Boys.
Patternmakers.
Patternmakers' Helpers.
Pipe Coverers (Heat, Frost and Asbestos Workers).
Pipe Fitters.
Pipe Fitters' Helpers.
Planer Hands.
Planers.
Planers' Helpers.
Plate Hangers, First Class.
Plate Hangers, Second Class.
Plate Hangers' Helpers.
Plumbers.
Plumbers' Helpers.
Polishers, Buffers and Platers.
Polishers' Helpers.

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Pressmen, First Class.
Pressmen, Second Class
Pressmen's Helpers.
Punchers.

Reamers (Pneumatic).
Regulators, First Class.
Regulators, Second Class.
Regulators' Helpers.
Riggers.
Riveters, Hand.
Riveters, Pneumatic.
Rivet Heaters.
Rivet Heater Boys.
Rivet Passers.
Rivet Testers.

Sawyers.
Saw Filers.
Saw Filers' Helpers.
Scarfters.
Sheet Metal Workers.
Sheet Metal Workers' Helpers.
Ship Carpenters, First Class.
Ship Carpenters, Second Class.
Ship Carpenters' Helpers.
Slab Furnace Men.
Slab Furnace Men's Helpers.
Specialists or Handymen.
Stage Builders.
Stage Builders' Helpers.
Steamfitters.
Steamfitters' Helpers.
Strikers (Furnace).
Switchmen, Yard.

Tank Testers.
Teamsters.
Tool Grinders.
Toolsmiths.
Toolsmith's Helpers.

Water Tenders.
Welders.

Welders' Helpers.
Wiremen.

6. *General Labor and Miscellaneous Class.*
Includes the following:
General Labor:
Cleaners.
Common Laborers.
Janitors.
Laborers.
Unclassified Labor.
Miscellaneous Labor:
Chauffeurs.
Cooks.
Doormen.
Guards.
Policemen.
Waiters.
Watchmen.
Other Miscellaneous Labor.

Classification of Major Labor Operations

The following classification of the basic units of labor costs includes the more important production labor operations. Charges of direct labor costs should be made to the job account or product unit according to the labor operations. The operation symbols will be used with the productive departmental designations for labor distribution to the job accounts or product units.

Where specific labor operations are not included in the following classification, the direct labor hours and costs of miscellaneous workers should be included under the miscellaneous operations group or under the distinctive operation symbols as may be deemed necessary.

Following is a list of some of the important productive labor operations and code symbols:



1. Annealing, Hardening and Tempering.
2. ASSEMBLING.
3. Bench, Vise and Floor Work.
4. Bending and Flanging.
5. Blacksmith Work.
6. BOLTING.
7. Boring Mills Work.
8. CHIPPING AND CAULKING.
9. Coremaking (Foundry).
10. DRILLING.
11. Engine Lathes.
12. ERECTING.
13. FABRICATING.
14. Finishing.
15. Fitting.
16. Furnace Work.
17. Grinding and Buffing.
18. Handling Steel.
19. LAYING OUT AND TEMPLATING.
20. Melting (Foundry).
21. Miscellaneous Operations.
22. Molding (Foundry).
23. PAINTING.
24. Planing.
25. PUNCHING AND SHEARING.
26. Reaming and Countersinking.
27. RIVETING—Machine.
28. RIVETING—Hand.
29. Rolling.
30. Sawing.
31. Scarfing.
32. Stamping (Sheet Metal).
33. Testing and Inspecting.
34. Turning and Winding.
35. Varnishing and Polishing.
36. Welding.

Time-Keeping and Cost Distribution

The value of accurate methods of reporting and recording the daily time of each employe for payroll mak-

ing and for proper distribution of labor hours and costs against production cannot be stressed too greatly. For accurate payroll making, for proper control of labor in production and for estimating and comparative purposes, it is necessary to have proper time-keeping methods, the essentials of which are as follows:

(a) Proper method of recording the daily time of each employe. There should be time clocks on which each worker should register in and out time, or there should be some other method of obtaining the same results.

(b) Job or operation tickets should be turned in by each worker for the various operations performed each day. On these job tickets there should be recorded the worker's number, the production order number, the product unit number, and the time taken on each operation.

Where mechanical and sorting tabulating equipment is available, the tabulating card and the job ticket can be one and the same, the requisite information being noted on the card in writing and the punching of the cards being done later in the time-keeping office.

(c) The total time and cost, as found from the daily in and out cards, as explained in paragraph (a) should check with the total time and cost of all the operations on job tickets. This check should be obtained daily by departments.

(d) The job tickets should be sorted by trades to obtain the actual hours, the number of hours converted into eight-hour days, the total pay received and the pay per eight-hour day. The total pay in this case should

[redacted]

check with the totals under paragraph (a) and paragraph (b).

(e) The job tickets should be sorted in order to obtain hours and pay on piece work, on day work, on overtime, on direct labor, and indirect labor, and on all of these by departments. The total pay in each case should check with totals obtained above.

(f) Job tickets should be sorted by labor operations and by job account or product unit numbers for posting to the cost summary sheets.

It will be noted from the amount of sorting and tabulating required that the use of tabulating and sorting machinery will be of considerable value.

SECTION XIII

EXPENSE—CLASSIFICATION AND METHODS

Purpose and Use of Classification

The cost of direct labor and direct material entering into production are applied directly to the job account or product unit. The costs of indirect labor and indirect material and other operating and fixed charge expense, which cannot be applied directly to the specific job account or product, are included under "expense."

To obtain accurate and uniform distribution of expense to the job accounts, the expense items are grouped under specific classes and expense accounts as given in the classification of expense. The expenses are applied to the job accounts or product units after they have been distributed to the specific departments. The basis and methods suggested for expense distribution to departments and expense application to the job accounts or product units are included under Section 6—"Principles and Specific Definitions—Expense."

Basis of Expense Classification

To accomplish the purposes set out above, all expense charges which fall under specific departmental groups have been included under departmental expense divisions. Those expense charges which are not departmental in their nature, are included under non-departmental expense divisions.

The principal divisions and sub-divisions in the expense classification, consist of the following:

1. Productive Departmental Expense.
2. General Works Expense.
   a. Departmental.
   b. Non-Departmental.
3. General Works Distributive Expense.
4. Auxiliary and Stock Manufacture Expense.
5. General Administrative Expense.
   a. Departmental.
   b. Non-Departmental.
6. Fixed Charge Expense.

Under each of these divisions are included specific expense accounts to which all expense charges should be made directly.

The divisions and sub-divisions of the expense classification have been so arranged that they will be applicable to any shipyard, and any changes in specific expense accounts can be made without affecting the main divisions.

Definitions of Principal Expense Divisions

1. *Productive Departmental Expense.*

Productive departmental expense includes the indirect charges of the respective productive departments. Distribution of productive department expense to job accounts or product units is discussed under Section 6—"Principles and Specific Definitions—Expense."

2. *General Works Expense.*

General works expense includes the indirect expenses chargeable to production costs which cannot be charged directly to some definite productive department and which cannot be applied to one of the other classes of expenses in the classifications which follow.

3. *General Works Distributive Expense.*

General works distributive expense includes all expenses directly attributable to the operation of the general works distributive departments.

4. *Auxiliary and Stock Manufacturing Expense.*

Auxiliary and stock manufacturing expense includes all expenses incurred in the operation of an auxiliary and stock manufacture department.

5. *General Administrative Expense.*

General administrative expense includes all expenses in connection with the conduct of the general administration or office activities of a shipbuilding company.

6. *Fixed Charge Expense.*

Fixed charge expense includes all expenses such as rent, taxes, interest, paid or accrued, insurance and depreciation; which are more or less fixed in character, being incurred whether the plant is in operation or not.

Detailed Expense Classification

1. *Productive Departmental Expense.*
   - 11. Salaries and Wages (includes supervision, such as foremen and other labor not directly chargeable to job accounts).
   - 12. Repairs and Renewals (includes labor, material and expense).
   - 13. Fuel and Lubricants.
   - 14. Tools and Parts.
   - 15. Miscellaneous Supplies and Expense.
   - 16. Pro rata share of General Works Distributive Expense.
   - 17. Pro rata share of Fixed Charge Expense.
   - 18. Miscellaneous Expenses (not included in the foregoing).

2. *General Works Expense.*

20. General Works Expense—Departmental.
    201. Salaries and Wages.
    202. Traveling and Entertainment Expense.
    203. Telegraph and Telephone Expense.
    204. Postage Expense.
    205. Publishing, Printing, Photographing and Blue Printing.
    206. Advertising.
    207. Miscellaneous Services.
    208. Supplies.
    209. Miscellaneous Expense (not included in the foregoing).

25. General Works Expense—Non-Departmental.
    251. Express, Freight and Drayage Expense (includes only amounts which cannot be charged directly to material and supplies).
    252. Repairs and Renewals (includes labor, material and expense).
    253. Pro rata share of General Works Distributive Expense applicable to General Works Departments.
    254. Pro rata share of Fixed Charge Expense applicable to General Works Departments.
    255. Licenses, Fees, Patent Rights, Royalties, etc.
    256. Miscellaneous General Works Non-Departmental Expenses (not included in the foregoing).

3. *General Works Distributive Expense.*

31. Salaries and Wages (includes salaries of Superintendents and other Supervisory Service).
32. Salaries and Wages (includes all other General Works Distributive Labor).
33. Repairs and Renewals (includes labor, material and expense).
34. Fuel and Lubricants.
35. Tools and Parts.
36. Miscellaneous Supplies and Expense.

37. Pro Rata Share General Works Distributive Expense (other General Works Distributive Departments).
38. Pro rata share of Fixed Charge Expense.
39. Miscellaneous Expense (not included in the foregoing).

4. *Auxiliary and Stock Manufacturing Expense.*
41. Salaries and Wages (includes supervision and other labor not directly chargeable to product manufactured).
42. Repairs and Renewals (includes labor, material and expense).
43. Fuel and Lubricants.
44. Tools and Parts.
45. Miscellaneous Supplies and Expense.
46. Pro rata share of General Works Distributive Expense.
47. Pro rata share of Fixed Charge Expense.
48. Miscellaneous Expense (not included in the foregoing).

5. *General Administrative Expense.*
50. General Administrative Expense—Departmental.
501. Salaries and Wages.
502. Traveling and Entertainment Expense.
503. Telegraph and Telephone Expense.
504. Postage Expense.
505. Publishing, Printing, Photographing and Blue Printing.
506. Advertising.
507. Miscellaneous Services.
508. Supplies.
509. Miscellaneous Expense (not included in the foregoing).
55. General Administrative Expense—Non-Departmental.
551. Legal and other expert services.
552. Engineering, Analytical and Experimental Expense.

553. Express, Freight and Drayage Expense (includes only amounts which cannot be charged directly to material and supplies).
554. Membership and Association Expense.
555. Repairs and Renewals (includes Labor, Material and Expense).
556. Corporate Taxes (includes only General Corporate Taxes. Income Taxes are charged to profit and loss. Taxes on real estate and building equipment are charged to "63" and prorated to departments).
557. Pro rata share of General Works Distributive Expense (applicable to central offices).
558. Pro rata share of Fixed Charge Expense (applicable to central offices).
559. Miscellaneous Expense (not included in the foregoing).

6. *Fixed Charge Expense.*
  61. Rent.
  62. Interest Paid or Accrued.
  63. Taxes.
  64. Insurance (includes fire insurance, burglary insurance, employers' liability insurance, fidelity insurance and other insurance).
  65. Depreciation.
  66. Other Fixed Charge Expense.

SECTION XIV

COST METHODS FOR PRODUCTION CONTROL AND ESTIMATES

Cost Accounting—an Instrument of Production

In the foregoing sections there are set forth the important principles and methods of collecting, classifying and distributing material, labor and expense charges to the different divisions of shipyard production. These complete charges are available for assembly into such summary cost reports and statistical statements which will furnish the required cost figures as well as control of production and operation efficiency.

Cost accounting methods are a valuable instrument for the control of production and operating efficiency when the cost reports and statistical statements are current and timely and are so arranged that these conditions can be readily visualized by the executive.

In addition to comparisons of costs on completed jobs, the summary cost reports should furnish to the executive, *while the jobs are in process*, the information for control of production and operations, as follows:

(a) Fluctuations in labor costs and labor efficiency by major labor operations; by departments, and for the plant as a whole—as measured by standards of performance and estimates.

(b) Fluctuations of material costs and amounts used, according to material classes and job accounts—as measured by standards of amounts required and estimates on the particular jobs.

(c) Fluctuations in the expense costs and ratios of expense to direct production costs—as measured by previous departmental expense charges and estimates.

(d) Production conditions on the various jobs and relationship of production to current costs and estimates.

Such cost reports and statistical statements will be supported by detail figures which should be available for the executive in ascertaining reasons for any fluctuations above and below standards and for purposes of improving production and operating conditions.

Cost Figures for Standards and Estimates

In addition to production and operating control, the cost figures will reach their greatest value when they are made a basis for standards and estimates. The use of operating cost figures for these purposes is premised on accurate collection, classification and distribution of the charges for material, labor and expense. The application of uniform cost methods should result in the accumulation of valuable data, to be used as the basis for the establishment of definite standards and as an aid in estimating costs of new work.

The operating statistics will show fluctuations in wages of labor and in prices of material. When unit costs fall below or above the estimates on account of changes in operation or economic conditions, the explanation given in the operating statistics will be the basis for the revision of estimates.

Standards for all elements of costs should be developed not only in terms of dollars and cents, but in terms of labor hours, machine hours, material quantities,

units of count and expense per labor hour. Comparisons in terms of dollars and cents are of value in cost control. The use of units of count will be of special value in gauging labor efficiency and material consumption and in estimating; regardless of fluctuations in rates of wages, purchase price of materials, etc.

The comparative summary report on the major labor operations should show in addition to the total production considered and the percent of work completed, the cost per unit and the labor hours for each operation. The labor operation standards will thus not only serve as measures of operating efficiency, but will also aid in connection with estimating.

Standards developed in connection with quantities and costs of materials should be of great value in drawing bills of materials and estimates and should provide indexes for checking of the quantity and cost of materials used on each job. Such standards will also be used in some instances as measures of the state of completion of jobs.

The establishment of department expense standards is of value for control of operating costs. With uniform and definite methods of expense distribution, it is possible not only to obtain comparable standards of departmental expense within individual yards, but these standards become available for the comparison of major expense items between shipyards.

SECTION XV

SUMMARY COST REPORTS AND STATISTICAL STATEMENTS

Arrangement of Summary Reports

The summary cost and statistical reports are the culmination of adequate cost accounting methods, and when figures become available for such reports, the proper functioning of the uniform cost methods in all the shipyards is assured.

To obtain maximum benefits from the uniform cost methods and the cost figures and standards, it is important that the summary cost and statistical statements be designed and arranged with a view of furnishing to the executive such information which is necessary to have knowledge of costs, production and operation conditions.

If the summary cost reports are to be of greatest value to the executives, the reports should be small in number and only the more important activities should be included. The figures should be arranged in a simple manner and should be avaiable for use at the earliest time possible after the close of the cost period.

A large number of reports and many details result in unintelligible statistical collections rather than interpretations of important conditions and facts. Where detailed statements and information are required, subsidiary reports should be prepared which will include details supporting the control reports.

These reports and statements should also be designed with a view to comparisons of the major items between shipyards. Shipbuilding executives may not find it desirable to compare all their items on the total costs, but if the summary reports are designed with a view to uniformity, there is no doubt but that they will derive considerable value from comparisons of important items in the respective shipyards.

Suggested Summary Cost Reports and Statements

The following are the important summary cost and statistical statements which have been laid out according to the plan of uniform cost methods recommended herein:

1. Comparative general balance sheet.
2. Comparative profit and loss statement.
3. Comparative statement of production operations.
4. Comparative statement of cost of completed jobs.
5. Statement of work in process.
6. Comparative statement of material inventories.
7. Comparative statement of major labor operations.
8. Comparative statement of expense costs.
9. Force statement by departments.

These controlling cost reports and statistics will be of use for the individual shipyards. Where comparisons are made between shipyards, the items to be compared will be arranged in a similar manner, the essential difference being that such reports will include comparisons of the major items in the different shipyards, whereas the individual shipbuilding reports are confined to all costs and production and operating conditions in the respective yards.

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1. *Comparative General Balance Sheet*:

Cost records should be a part of the general accounting scheme. Such cost records should be tied in with the general books so that all transactions are converged into a comprehensive statement of results of shipyard operations and general financial conditions.

The comparative general balance sheet, shown on Table II, represents the unification of cost accounting and general accounting under one set of controlling accounts. The submission of this statement shortly after the close of each cost period should serve as a simple and concise statement of financial and operating conditions of the business for use by the management.

The essential difference between this statement and the ordinary balance sheet is in the work in process accounts. By means of these it is possible to show for each cost period the cost of work in process. The work in process accounts are charged with all materials, labor and expense used and they are credited with completed work at cost.

2. *Comparative Profit and Loss Statement*:

The comparative profit and loss statement presents a comparison of the summary financial operations of the shipyard as represented by total profits for each group of completed production orders; miscellaneous profits; losses and such expenses as are not chargeable to production.

The profit and loss statement lends itself to the use of the control report method. Thus in the item of profits on ship construction jobs, supporting schedules showing in detail the profits on the individual orders completed during the period are prepared.

The controlling accounts on which information should be furnished each cost period, for the preceding period, and the total for the year to date are shown in the suggested comparative profit and loss statement given on the next page.

3. *Comparative Statement of Production Operations*: The statement of production operations will be prepared from the controlling cost accounts which are kept either in the factory ledger or in the general ledger. This statement may be prepared for all the classes of production orders or separately under each class of production orders.

The statement will not only show the various elements of cost entering into production costs but will also furnish a proof of the correct distribution of these costs by accounting for them in completed work and in work in process for the period and also in the proven balances shown by the controlling cost accounts.

The cost of operations should be shown for the current period and the period preceding, as well as the total for the year to date.

The production operation statement should include the following items:

(1) Direct Materials (not requisitioned from general stores).
(2) Direct Materials (purchased during period and including freight, express and drayage).
(3) Direct Labor for Period.
(4) Expenses (itemized according to expense classification).
(5) Total.
(6) Work in Process (beginning of period).
    (a) Direct materials in process.

Profit and Loss Statement

CREDITS	Date of End of Current Period	Date of End of Previous Period	Total for Year to Date
Production Profits—			
Construction Orders—Ships........			
Construction Orders—Special Contracts...........................			
Construction Orders—Ship Product Stock............................			
Auxiliary and Stock Manufacturers' Orders..........................			
Vessel Repair Orders..............			
Miscellaneous Orders..............			
Total......................			
Deduct Cost of Defective Work Orders not chargeable to production.			
Net Profits from Production....			
Non Production Profits—			
Profits on Investments............			
Profits on Sale of Property.........			
Income on Investments...........			
Premiums on Stock................			
Discounts on Purchases............			
Miscellaneous Credits.............			
Total Non-Production Profits..			
Total Credits.................			
DEBITS			
General Administrative Expense— (Not chargeable to production)			
Sales Expense..................			
Advertising........................			
Interest and Discount...........			
Bad Debts.........................			
Judgments and Fines............			
Other Losses......................			
Total Debits.................			
Profit and Loss Balance....			

TABLE III

(b) Direct labor.
(c) Expense.
(7) Total.
(8) Less, Work in Process (end of period).
(a) Direct materials in process.
(b) Direct labor.
(c) Expense.
(9) Net Production Costs.

4. *Comparative Statement of Cost of Completed Jobs*:

The statement on comparative cost of completed jobs should be arranged according to production orders. Under each division the different types of ships or orders are listed according to hull or contract number and summary costs are analyzed as to material, direct labor and expense by main groups of product units. Comparisons are also made between actual cost of each of the main divisions and in total, with standard of estimated costs.

Cost figures are added to this statement as jobs are completed. Statement of individual jobs completed is prepared in such a way that the cost of each main group of product units can be compared with the cost of the same group in other jobs of the same type.

The important headings of the columns for such a comparative statement are as follows:

1. Number of hull or order.
2. Date keel laid.
3. Date of launching hull.
4. Date ship completed.
5. Total cost of ship completed.
6. Cost per unit.
7. Standard estimated unit cost.
8. Per cent above or below standard.
9. Total ship or order cost.
   (a) Structural hull manufacture.



(b) Machinery manufacture.
(c) Hull finishing and outfit manufacture.
(d) Structural hull erection and construction.
(e) Machinery installation.
(f) Hull finishing and outfit.
(g) Direct general charges.
(h) Total cost.

10. Total direct material cost.
(a) Structural hull manufacture.
(b) Machinery manufacture.
(c) Hull finishing and outfit manufacture.
(d) Structural hull erection and construction.
(e) Machinery installation.
(f) Hull finishing and outfit.
(g) Direct general charges.
(h) Total cost.

11. Total direct labor cost.
(a) Structural hull manufacture.
(b) Machinery manufacture.
(c) Hull finishing and outfit manufacture.
(d) Structural hull erection and construction.
(e) Machinery installation.
(f) Hull finishing and outfit.
(g) Direct general charges.
(h) Total cost.

12. Total expense cost.
(a) Structural hull manufacture.
(b) Machinery manufacture.
(c) Hull finishing and outfit manufacture.
(d) Structural hull erection and construction.
(e) Machinery installation.
(f) Hull finishing and outfit.
(g) Direct general charges.
(h) Total cost.

Instead of the main groups of product units shown under columns 9 to 12 inclusive, information on completed job costs can be obtained under the main divisions of shipyard functions, viz.: (1) Manufacture of ship parts and (2) Ship Construction and Machinery

and Outfit Installation. Details under these main divisions should be available when supporting information is desired.

5. *Statement of Work in Process.*

The statement of work in process shows the cost and progress made on production orders on which work has not been completed and at the end of each period. It serves, therefore, as a complete analysis of all money tied up in work in process, as is represented by the item "Work in Process" in the comparative general balance sheet.

The costs are analyzed according to the classes of production orders and under each of the main groups of product units by the elements of cost.

The actual cost to date should be compared with standards or estimated costs on the basis of percentage completed, so that a general idea may be obtained whether or not the cost of work completed to date is exceeding the estimate.

The following are the important headings of the columns for the statement of the work in process:

1. Number of hull or order.
2. Total cost to date.
3. Estimated or standard cost.
4. Per cent expended to date.
5. Unit cost to date.
6. Standard or estimated unit cost.
7. Per cent above or below standard.
8. Total ship or order cost to date.
   - (a) Structural hull manufacture.
   - (b) Machinery manufacture.
   - (c) Hull finishing and outfit manufacture.
   - (d) Structural hull erection and construction.
   - (e) Machinery installation.

(f) Hull finishing and outfit.
(g) Direct general charges.

9. Direct material cost to date.
   (a) Structural hull manufacture.
   (b) Machinery manufacture.
   (c) Hull finishing and outfit manufacture.
   (d) Structural hull erection and construction.
   (e) Machinery installation.
   (f) Hull finishing and outfit.
   (g) Direct general charges.
   (h) Total material cost to date.
10. Direct labor cost to date.
   (a) Structural hull manufacture.
   (b) Machinery manufacture.
   (c) Hull finishing and outfit manufacture.
   (d) Structural hull erection and construction.
   (e) Machinery installation.
   (f) Hull finishing and outfit.
   (g) Direct general charges.
   (h) Total labor cost to date.
11. Expense cost to date.
   (a) Structural hull manufacture.
   (b) Machinery manufacture.
   (c) Hull finishing and outfit manufacture.
   (d) Structural hull erection and construction.
   (e) Machinery installation.
   (f) Hull finishing and outfit.
   (g) Direct general charges.
   (h) Total expense cost to date.

In addition to information of total costs of work in process of ship construction orders, the costs of work in process of such items as manufacture of stock and equipment, new plant construction, manufacture of tools, etc., should be shown in this statement.

6. *Comparative Statement of Material Inventories.*

This statement shows the amount of inventory of general stores, materials and supplies, and materials in work in process, giving comparative quantities on hand and

cost values for the current cost period and the period preceding.

It will not be necessary to include all detail items under the material inventories, only the more important divisions and those of doubtful character being shown.

The following is a suggested form of comparative statement of materials inventory:

	Date of End of Current Period		Date of End of Previous Period		Increase or Decrease	
	Amt.	Cost	Amt.	Cost	Amt.	Cost
Materials and Supplies— (General Stores)						
1. Materials....................						
2. Parts..........................						
3. Structural Units Complete...						
6. Supplies......................						
Total................						
Materials in Process— (List by production orders)						
Total................						
Total Inventory.......						

7. Comparative Statement of Major Labor Operations:

This statement shows the comparative costs by cost periods of the more important labor operations, such as assembling, erecting, bolting, drilling, molding, riveting, chipping and caulking, painting, etc.

Following is the information which should be shown for the current period and at least two previous cost periods:

1. Operation designation or symbol.
2. Unit of count.

3. Number of units in completed order.
4. Number of units completed during the period.
5. Number of workers involved.
6. Number of direct labor hours during period.
7. Number of units completed per hour.
8. Total direct labor cost.
9. Cost per unit.
10. Standard cost per unit.
11. Cost per unit—piecework basis.
12. Cost per unit—daywork basis.

8. *Comparative Statement of Expense Costs*:

This statement shows the relation between direct labor and expense by the operating departments.

The direct labor hours, the amount paid for direct labor, the total labor cost, the amount of expenses and the expense per labor hour and the expense per cent to direct labor cost, both for each cost period and the average for the year to date, should be shown for each department and in a total.

Expense items which are not chargeable directly to specific departments should be set out either in this statement in the form of general works expense—non-departmental and general administrative expense—non-departmental. Such expense costs, added to the expenses of the respective productive departments will furnish data on the total chargeable expense. Separate comparative statements analyzing the general works expense and the general administrative expense may also be prepared in case the information under this comparative expense statement is found insufficient.

Similar comparative statements of the auxiliary and stock manufacturing department operations and ex-

pense should be prepared in those shipyards where such departments are in existence.

9. *Force Statement by Departments*:

This statement presents a summary of the payrolls by departments and in total and will be of value in providing statistics on labor and employment conditions.

The following are some of the more important items on which labor statistics should be obtained:

(a) Number of workers of each class.
(b) Number of hours worked.
(c) Amount earned—regular time.
(d) Amount earned—overtime.
(e) Amount earned—total.
(f) Total eight-hour workdays.
(g) Rate per eight-hour day.
(h) Amount earned—piecework.
(i) Amount earned—daywork.
(j) Total direct labor.
(k) Total indirect labor.
(l) Total all labor.
(m) Percentage of piecework to total direct labor.
(n) Percentage of indirect labor to total labor.
(o) Rate of turnover.
(p) Number of accidents.
(q) Number of employes in training.

Miscellaneous Reports and Operating Statements

The preparation of the summary cost reports and statistical statements suggested above will necessarily involve the making of a number of supporting statements which will be used by executives where additional information on reasons for fluctuations and changes is desired.

[redacted]

Also other summary cost and operating statements will suggest themselves and will be requested when the summary cost reports are used by the executives. When the cost records and general books of accounts permit the preparation of such summary reports and statements as suggested above, additional statements can readily be prepared on request by the management or by the operating heads.

[redacted]

Appendix "A"

TABLE OF RATES OF DEPRECIATION

Recommended by

COMMITTEE ON DEPRECIATION

of the

ATLANTIC COAST SHIPBUILDERS' ASSOCIATION

December 11, 1918

General Classification	Life Years	Rate of Depreciation, %	Detailed Classification	Life Years	Rate of Depreciation, %
Buildings........	25	4	**Buildings—**		
			Stone, brick, concrete, with or without steel frame and masonry curtain wall buildings...........	30	3⅓
			Steel with corrugated sheet iron or steel plate.........	20	5
			Steel or corrugated sheet iron with wood.	15	6⅔
			Power plant buildings..............	20	5
			Wood buildings.....	10	10
			Piers, bulkheads, wharves and docks..	20	5
			Launching ways (fixed structure) wood..............	10	10
			Concrete...........	13⅓	7½
			Water tanks and steel stacks.............	15	6⅔
			Drydocks, basin, masonry or concrete.	40	2½
			Wood..............	25	4
			Concrete and brick bins, fences and miscellaneous concrete and brick structures.	20	5
			Wood bins, fences, racks and other wood structures..........	5	20
Machinery and Tools (including foundations).....	15	6⅔	**Power Machinery—**		
			Electric generators, switchboards, and power house equipment; boilers and boiler house equipment, including economizers, feed water heaters, injectors, stacks, uptakes, etc.	15	6⅔
			Engines, gas and oil.	11¾	8½

[redacted]

General Classification	Life Years	Rate of Depreciation, %	Detailed Classification	Life Years	Rate of Depreciation, %
			Engines, steam, including pile drivers, hoisting engines, compressors, air pumps, vacuum pumps, etc.	10	10
			Pumps, water supply, feed water, fire, etc.	18	5½
			Electric motors and controllers	11¾	8½
			Coal and ash conveyors	20	5
			Shop Machinery—		
			Hydraulic forging presses, bending presses and fluid compressors	30	3⅓
			Hammers, steam drop or helve	10	10
			Machine tools, lathes, slotters, planers, boring mills, drilling, boring and milling machines	15	6⅔
			Miscellaneous shop machinery and equipment, including small scales, spare parts, etc.	5	20
			Wood working machinery	20	5
			Small tools	10	10
			Cranes, Elevators, etc.—		
			Cranes, electric, hydraulic, steam and hand power, jib and davit; hand, electric or air hoists, derricks, lifting magnets and charging machines	15	6⅔
			Locomotive cranes, steam and electric	10	10
			Elevators	20	5
			Craneways	25	4
Portable Pneumatic, Electric and Hydraulic Tools; Portable Hand, Electric, Hydraulic or Pneumatic Hoists and Lifting Devices; Small Jib Cranes	3	33⅓	Portable Pneumatic, Electric and Hydraulic Tools; Portable, Hand, Electric, Hydraulic or Pneumatic Hoists and Lifting Devices; Small Jib Cranes	3	33⅓
			Furnaces and Forges		
			Heating, treating and annealing furnaces, brass foundry melting furnaces, oil furnaces, etc.	10	10
			Blast, furnaces,		

General Classification	Life Years	Rate of Depreciation, %	Detailed Classification	Life Years	Rate of Depreciation, %
			stacks and stoves, soaking pits, open hearth and crucible melting furnaces, cupolas, etc.	25	4
			Formers and drop forge dies	5	20
Other Equipment (trackage, piping, wiring, etc.	22	4½	**Other Equipment—**		
			Railroad tracks, including rails, ties, ballast, excavation, grading, etc.	22	4½
			Trestles, steel	25	4
			Wood	15	6⅔
			Bridge and retaining walls	33⅓	3
			Marine railways	30	3⅓
			Fire systems and apparatus	5	20
			Piping and wiring; piping for steam and exhaust, air, oil, gas and water lines, pneumatic and hydraulic transmission, electric light and power systems, wiring, feeder and other outside wiring, including poles	16⅔	6
			Heating and ventilating systems, drying apparatus	20	5
			Sanitary and water supply systems, sewers and drainage systems	25	4
			Floating equipment, barges, boats, scows, motor-boats	5	20
			Portable launching ways	5	20
			Floating drydocks	20	5
			Stable and garage equipment	3	33⅓
			Motor trucks and automobiles	3	33⅓
			Locomotives, steam and electric	15	6⅔
			Cars used by Transportation Department	10	10
			Scales, large	10	10
			Water purifier	15	6⅔
			Pickling tanks, etc.	3	33⅓
Furniture and Fixtures	5	20	**Furniture and Fixtures—**		
			Office equipment, shop, yard, store and tool room fixtures, typewriters, adding machines, etc., lockers, wardrobes, etc.	5	20

Appendix "B"

DEFINITION OF DEPRECIATION AND AMORTIZATION AS DEFINED IN TREASURY DECISION No. 2384

Decision No. 2384 (Internal Revenue), issued as Regulation No. 89 on October 24, 1916, by the United States Treasury Department, defining depreciation and amortization, as stated in the munitions tax law, contains the following:

"Art. XX. The deduction authorized on account of depreciation relates to the loss due to use, wear and tear of physical property, owned and used by the manufacturer, but which is not specially designed or installed for the purpose of manufacturing munitions or parts thereof, and which, without material alteration and change, may be used in connection with any other business in which the person is or may be hereafter engaged.

"The annual deduction on this account will be a reasonable allowance determined upon the basis of the cost and probable number of years constituting the life of the property.

"If the same building and machinery or other equipment are used coincidentally for purposes other than the manufacture of munitions or parts thereof, then the amount deductible from the gross income returned for the purpose of this title on account of depreciation will be apportioned in accordance with the rule hereinbefore set out for apportioning running expenses, and the deduction from the gross income contemplated by this title will be made accordingly.

"Art. XXI. Section 302 of this title authorizes a deduction to meet the conditions peculiar to each concern, and has for its purpose the amortization of the values of buildings and machinery constituting special plants, which will, except for salvage, have no substantial value to the manufacturer when the contracts executed or to be executed for the manufacture of munitions or parts thereof have been fully performed.

"The deduction authorized on this account relates to property (buildings, machinery and equipment) specially constructed or installed for use in the manufacture of mu-

nitions or parts thereof, and which, when no longer useful for this purpose, cannot without material alteration or change, if at all, be used for any other purpose, the life of which property is substantially coincident with the life of the contracts.

"The annual allowance to be deducted on this account will be determined by estimating the probable number of years the property will be used in the manufacture of munitions or parts, and by dividing the cost of such property, less estimated salvage by such probable number of years. The quotient thus obtained will measure the amount to be deducted each year on account of amortization, until the cost of the property has been extinguished. Or the cost of the property may be amortized on the basis of the quantity of munitions or parts thereof manufactured under contracts in connection with the fulfillment of which the buildings and machinery or equipment were specially constructed or installed.

"Neither the depreciation nor the amortization deduction allowable in the return made for the purpose of this title will relate to property used in connection with any other business carried on by the manufacturer. Amortization applies only and particularly to those special plants and equipment whose life and value, except salvage, will terminate with the end of the business for which they were erected and equipped. It is to be differentiated from depreciation in that depreciation relates to property whose life and value is not dependent upon or materially affected by its use in the manufacture of munitions or parts thereof."

Appendix "C"

CLASSIFICATION OF ASSET TOOLS AND PERISHABLE TOOLS COMPILED AT A CONFERENCE WITH TOOL MANUFACTURERS

(Nicholson & Rohrbach—"Cost Accounting"—Pages 509-510)

ASSET TOOLS:

- Back Rests for Swing Tools.
- Benches.
- Bench Centers.
- Calipers.
- Chucks.
- Chucks for Screw Machines.
- Chucks for Special Machines.
- Countershafts.
- Cutting Attachments.
- Depth Gages.
- Die Holders.
- Drilling Attachments.
- Feed Attachments.
- Fixtures:
  - Breaching.
  - Edging.
  - Handmilling.
  - Milling.
  - Rolling.
  - Splining.
  - Stamping.
  - Tapping.
- Floating Holders.
- Forming Tool Holders.
- Gages.
- Gear-Cutting Attachments.
- Gear Teeth.
- Hangers.
- Index Centers.
- Indicators.
- Knurl Holders.
- Micrometers.
- Milling Attachments.
- Plain Pulleys.

[redacted]

Plain Vises.
Planer and Shaper Gages.
Plates.
Plugs.
Plungers.
Pointing Tools.
Pointing Tool Holders.
Profiles.
Prongs.
Pulleys.
Saw Frames.
Slotting Attachments.
Special Tools and Holders.
Snaps.

PERISHABLE TOOLS:

Arbors.
Box Tools for Screw Machines.
Broaches—for Key Way.
Bushing.
Cutting and Special Holes—similar to Splining.
Chisels.
Circular Cut-Off Tools.
Circular Form Tools.
Circular Thread Tools.
Collet Blanks.
Counter Bores.
Countersinks.
Cutters.
Dies—Threading—all sizes.
Die Holders.
Drill Tips.
Drill Shanks.
Drills—all sizes.
Edging Cutters.
End Mills.
Files—all kinds and sizes.
Forming Tools.
Grinding Wheels—all kinds and sizes.
Handmilling Cutters—numerous.
Inscription Rolls.
Jigs.

Milling Cutters—numerous shapes, sizes and cutting edges.
Mallets.
Mandrels—sometimes called Arbors.
Paper Gages.
Punches and Dies.
Polishing Holders.
Reamers—Hand and Machine.
Reamer Shanks.
Roughing Tools.
Slot Cutters.
Screwdrivers.
Slotting Saw— Hackney, Circular.
Splining Tools—similar to Broaches.
Stamps
Stamps—Marking.
Steel Sockets.
Taps.
Threading Dies.
Thread Gages.
Turning Tools—numerous shapes and cutting edges.
Tweezers.
Twist Drills.
Wire Gages.
Wrenches—all kinds, shapes and sizes.





